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REVIEW
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VIÉGAS (A. P.). **A podridão das raízes de Mandioca.** [The root rot of Cassava.]—*Rev. Agron., Pôrto Alegre*, 17, pp. 205–208, 2 figs., 1955. [English summary.]

Rosellinia bunodes, inoculated into healthy cassava plants growing in cement pots at the Agronomic Institute, Campinas, Brazil, caused a root rot [cf. *R.A.M.*, 30, p. 96] identical in every respect with that occurring on samples collected in the field in the State of Santa Catarina. The symptoms included necrosis and collapse of the cortex of the collar, accompanied by longitudinal swelling and cracking of the tissues above the dead area, foliar chlorosis resembling that induced by nitrogen deficiency, rapidly followed by wilting of the leaves and buds, and partial or total desiccation.

The fungus was also pathogenic to coffee [cf. 27, p. 542] in inoculation experiments.

NISIKADO (Y.) & WATANABE (K.). **On a Lotus anthracnose new to Japan.**—*Ber. Ōhara Inst.*, 10, 3, pp. 117–122, 11 figs., 1955.

Anthracnose of lotus (*Nelumbo nucifera*), tentatively referred to *Gloeosporium nelumbii* (F. Tassi in *Bull. Lab. Orto bot. Siena, 1900*, p. 130, 1900), was observed for the first time in Japan in 1954, when heavy infection occurred during the rainy season of July in commercial fields at Kurashiki, Okayama Prefecture. The disease resembles rhizome rot [*Fusarium bulbigenum* var. *nelumbicolum*: *R.A.M.*, 33, p. 404] but is less destructive, though the yield of rhizomes may be reduced to a third or even a quarter of the normal. The leaf lesions are purple to black and those on the petioles purple to dark grey, bearing on their surfaces salmon-coloured acervuli, 80 to 200 μ in diameter. The hyaline conidiophores measure 18 to 36 by 2·5 to 4·5 μ and the hyaline, continuous, cylindrical, fusoid or long ovoid conidia 15·5 to 20 by 3·25 to 4·8 (average 17·5 by 3·75) μ. Positive results were obtained in inoculation experiments on young leaves and petioles with conidia from monospore cultures on potato decoction agar.

ELLIS (D. E.). **Cucurbit diseases in North Carolina and their control.**—*Bull. N.C. agric. Exp. Sta.* 380, 12 pp., 23 figs., 1953.

The major diseases affecting cucurbit crops in North Carolina are described and illustrated by excellent photographs, with brief notes on their control. Angular leaf spot (*Pseudomonas lachrymans*) [*R.A.M.*, 31, p. 472] is important only on cucumber but anthracnose (*Colletotrichum lagenarium*) [35, p. 71] is also severe on cantaloupe and watermelon. Downy mildew (*Pseudoperonospora cubensis*) [loc. cit.] is serious on cucumber and cantaloupe but less so on squash and watermelon. Of major importance on watermelons are *Fusarium oxysporum* f. *niveum* [*F. bulbigenum* var. *niveum*: 32, p. 360] and *Mycosphaerella melonis* [30, p. 302], the latter also attacking cucumber and cantaloupe. Poor stands of seedling cucurbits are due to decay and damping-off caused by *Rhizoctonia* spp. and *Pythium* spp.: summer

squash and cucumber in the mountain area are less affected by scab (*Cladosporium cucumerinum*) [35, p. 73]. Less important diseases are caused by *Erwinia tracheiphila* [30, p. 505], *Choanephora cucurbitarum* [28, p. 108], *Alternaria cucumerina* [32, p. 360], and a relatively new disease of summer squash caused by *Phytophthora* sp. which does severe damage in wet weather.

The importance of crop rotations and other sanitary practices is stressed and recommendations are made for the use of fungicides and the planting of resistant varieties against specific diseases, which are finally summarized in tabular form. Thus mercurial seed treatment is recommended against angular spot of cucumber; ziram or zineb sprays against anthracnose and the cultivation of Congo and Fairfax watermelons; basic copper sulphate against downy mildew and planting Palmetto and Santee cucumber and Rio Sweet, Texas No. 1, and Smith's Perfection cantaloupes; seed treatment, sprays, or dusts against *M. melonis*; seed treatment and zineb and ziram sprays against scab; seed treatment against damping-off; and the planting of Blacklee, Hawksbury, Miles, Leesburg, Ironsides, Dixie Queen Wilt Resistant, or Fairfax varieties, which are resistant to *Fusarium* wilt.

CANOVA (A.). **Sull' oidio della Barbabietola osservato in Italia.** [On powdery mildew of Beet observed in Italy.]—*Ann. Sper. agr.*, N.S., 8, 4, pp. 1181–1186, 2 figs., 1954. [English summary.]

Sugar beet and *Beta maritima* plants growing in greenhouses in the province of Ferrara, Italy, are frequently affected by powdery mildew caused by a species of *Erysiphe* [cf. *R.A.M.*, 29, p. 240], and in 1952 the disease was recorded in the field, for the first time in Italy. On infected leaves the conidiophores consist of simple, not very long, mycelial threads separated from the mycelium by a transverse septum and generally ending in a chain of two to five cylindrical conidia with rounded ends measuring 34 to 54 by 14 to 20 (average 43·2 by 17) μ. The author concludes from his own observations and from a study of the literature that the disease as it occurs in various countries is probably caused by a single species, the conidial stage of which is *Oidium erysiphoides* and the ascigerous *Erysiphe communis* [*E. polygoni*]. The latter was not observed by the author.

CASARINI (B.). **Prove di lotta contro la ruggine del Fagiolo (Uromyces appendiculatus (Pers.) Lk.).** [Experiments on the control of Bean rust (*Uromyces appendiculatus* (Pers.) Lk.).]—*Ann. Sper. agr.*, N.S., 8, 4, pp. 1173–1180, 1 pl., 1955. [English summary.]

In an experiment carried out at the Experimental Laboratory of Plant Pathology, University of Bologna, Italy, potted dwarf bean [*Phaseolus vulgaris*] plants of the Cento per Uno variety were sprayed with solutions of Caffaro powder (1 per cent.), 'tiosol' wettable sulphur (1 per cent.), 'exina' (a synthetic product based on zineb and not containing copper, used at 0·5 per cent.), and 'cuprexina' (a similar synthetic product, but containing copper, used at 0·5 per cent.). After being allowed to dry the plants were inoculated with *Uromyces appendiculatus* by applying a spore suspension of the fungus to both surfaces of the leaves. Evaluation of intensity of attack was made by counting the lesions as soon as they appeared on the first two leaves that were already well developed when inoculated, and again four to five days later, using an index of infection ranging from 0 (no spots present) to 6 (over 100 spots per leaf).

At the first examination, the index figures for the above-mentioned treatments were, respectively, 2·2, 0·8, 0·4, and 0·7, as against 5·27 for the untreated; at the second, the corresponding figures were 2·7, 0·9, 0·5, 0·65, and 5·48. Thus, the best control was given by 'exina', 'cuprexina' being slightly less effective. Both 'exina' and 'cuprexina' were also shown experimentally to have some slight systemic effect against infection, but this was too small to be of practical use.

Knapp (E.). **Cercospora und Ultraschall.** [*Cercospora* and ultra-sound.]—*Zucker*, 8, 15, p. 329, 1955.

The results of experiments at the Max Planck Institute for Breeding Research, Ladenburg (Neckar), Germany, confirmed Koch's observations [*R.A.M.*, 35, p. 62] as to the prevention of inactivation of *Cercospora* [*beticola*] on beet seed, the normal consequence of a year's storage, by ultrasonic treatment. Thus, the disease ratings assigned on 12th August, 1953, to the eightfold replicated plots sown on the previous 31st March with treated seed were uniformly higher than in the controls, while the yields per ha. at harvesting on 28th to 29th September were lower in the former (154·8, 377, and 61·6 doppelzentner [1 dz. = about 2 cwt.] leaves, roots, and sugar, respectively), than in the latter (184·8, 396·2, and 67·8).

Treggi (G.). **Virosi e fusariosi del Fagiolo nella zona dell' Agro pisano.** [Virosis and fusariosis of Bean in the region round Pisa.]—*Ann. Sper. agr.*, N.S., 8, 4, pp. 1213–1226, 5 figs., 1954. [English summary.]

During 1953, beans [*Phaseolus vulgaris*] growing in various localities near Pisa, Italy, developed a condition in which they either failed to reach maturity or their yield was much diminished. Affected plants were dwarfed, their leaves malformed, and the root system greatly reduced, the tap-root being absent or very small. The leaf symptoms were regarded as due to bean mosaic virus [*R.A.M.*, 12, p. 413; 17, p. 645].

Of every 20 seeds from affected plants sown in gauze-covered pots and boxes, at least 18 gave plants with mosaic symptoms, and the affected plants were noticeably smaller than those grown from healthy seed. The average dimensions of 1,000 seeds from healthy plants were 14·4 by 8·66 mm., the weight and volume per lot of 1,000 being, respectively, 414 gm. and 490 cc.; the corresponding figures for seeds from mosaic plants were 13·8 by 8·22 mm., 392 gm., and 460 cc.

The most conspicuous symptom was a darkening of the collar, followed by rotting and disorganization of the terminal part of the tap-root, which was sometimes thickened and discoloured, with small, longitudinal cracks. Affected roots, which occasionally included the laterals, yielded *Fusarium solani*.

Soil inoculation of potted Bianco pisano bean and Telefono pea plants with the fungus obtained from infected material gave 100 per cent. diseased bean plants, 80 per cent. of which died, and 12 per cent. diseased pea plants, as against no diseased controls. In a second experiment, seed from healthy and mosaic plants was sown in soil which was inoculated with *F. solani*. All the plants became infected but those grown from mosaic seed sooner and apparently more severely than the others.

Glasscock (H. H.) & Moreton (B. D.). **Cauliflower mosaic in East Kent.**—*J. Minist. Agric.*, 62, 6, pp. 270–274, 1955.

Cauliflower mosaic [cf. *R.A.M.*, 33, p. 397], recognized as a major virus problem in Cornwall and Devon before 1938, was comparatively rare in Kent until 1948 and 1949, when it so reduced the size and quality of the curds as to make the cultivation of broccoli unprofitable. The disease then decreased during the next five seasons to negligible proportions, but is still a potential threat.

The aphids *Myzus persicae* and *Brevicoryne brassicae* are the main vectors, and long-standing broccoli seed plants and nearby brassica crops act as sources of infection; the remains of such crops should therefore be promptly destroyed.

The main sources of infection are diseased seedlings introduced from commercial seed-beds. These should therefore be sited in areas where no other brassicas are grown and should be insulated by barrier crops. Trials in 1953, surrounding five rows of broccoli seedlings with three rows of barrier plants, showed barley, [?broad] beans, and kale to be effective in that order, in one trial reducing mosaic incidence

from 7 per cent. in unprotected broccoli to 3·9 to 1·1, though these figures cannot be taken as conclusive [see below p. 150].

AGARWALA (S. C.) & HEWITT (E. J.). **Molybdenum as a plant nutrient. V. The interrelationships of molybdenum and nitrate supply in the concentration of sugars, nitrate and organic nitrogen in Cauliflower plants grown in sand culture. VI. Effects of molybdenum supply on the growth and composition of Cauliflower plants given different sources of nitrogen supply in sand culture.**—*J. hort. Sci.*, 30, 3, pp. 151–162, 163–180, 1 pl., 3 graphs, 1955.

These investigations conducted from 1951 to 1954 at Long Ashton Research Station, Bristol, on the role of molybdenum in the growth of cauliflower plants [cf. *R.A.M.*, 34, p. 120] have been reported more briefly elsewhere [31, p. 466; 33, p. 193].

The experiments have shown that molybdenum influences growth or metabolism in cauliflower plants given nitrate (*J. hort. Sci.*, 29, pp. 278 and 291, 1954). Besides primary and whiptail symptoms, the content of ascorbic acid, sugars, and chlorophyll is affected. Primary molybdenum deficiency symptoms of mottling, wilting and scorching (produced with 0·000005 to 0·00005 p.p.m.) occurred consistently only in the presence of plant nutrient containing nitrate, and are regarded as the result of the interaction between nitrate nutrition and molybdenum deficiency. Whiptail symptoms were produced and yields decreased at low molybdenum levels regardless of the source of nitrogen.

Molybdenum requirement was greatest with nitrate or ammonium nitrate, least with other ammonium and nitrite compounds. The addition of citrate or malate apparently accentuated symptoms with nitrate or nitrite present, but not with urea or ammonium compounds. It is concluded that molybdenum is essential to cauliflower, regardless of the nitrogen source, and plays a multiple part in its metabolism in addition to that in nitrate reduction.

HOLMES (F. O.). **Additive resistances to specific viral diseases in plants.**—*Ann. appl. Biol.*, 42 (*Proc. Jubilee Mtg, Lond., 1954*), pp. 129–139, 1955.

The author puts forward the view that the many examples of complete immunity from specific diseases in nature may constitute random assemblages of similar genetic mechanisms in groupings of a higher order. The possibility of constructing powerful systems conferring strong resistances to or complete immunities from specific diseases by combining numerous genes, individually of almost negligible effectiveness, is discussed in relation to additive resistance to spotted wilt virus in tomato [cf. *R.A.M.*, 33, pp. 325, 642] and to mosaic virus in tobacco [cf. 32, p. 282; 33, p. 641]. Future investigations may show whether it is possible in this manner to provide effective protection for species now regarded as completely susceptible to specific diseases.

BAWDEN (F. C.). **The spread and control of plant virus diseases.**—*Ann. appl. Biol.*, 42 (*Proc. Jubilee Mtg, Lond., 1954*), pp. 140–147, 1955.

The author points out that modern cultivation methods favour the spread of plant viruses even more than that of other parasites and diseases. Two modern factors discussed which may contribute especially to this spread are the increasing use of clonal varieties and improved standards of manuring and cultivation.

So far, tests with insecticides for the control of vectors have been directed mainly against aphids, though leafhoppers and thrips, which do not become infective immediately they start to feed on an infected plant, might be expected to be more amenable. Much more information about the 'ecology' of viruses and further

examination of insects which may be vectors are required before the possibilities of control by any method at all can be assessed. The losses now caused by contact transmission of tobacco mosaic virus in tomato and tobacco crops would fully justify extensive trials with 'inhibitors', such as skimmed milk, which has recently shown promise, and various other unusual materials.

If immunity from viruses cannot be achieved, there are many other qualities for which breeding can be undertaken, such as resistance to initial infection or ability to localize it, and resistance to a specific vector. Virus variants with new pathogenic properties can be expected to occur even more frequently than in the case of larger pathogens.

There can be no universal panacea, but methods of controlling virus diseases in annual or short-lived crops will probably be found. The outlook is less promising for trees and other perennials, on which virus diseases are being increasingly recorded. These diseases demand more attention than they have yet received, and the search for chemotherapeutic or prophylactic substances is economically worth while, even though the likelihood of finding them is small.

In Britain the study of plant virus diseases has hitherto been largely confined to research establishments; it is to be hoped that in the future university botanical departments will also lend their aid.

SHEFFIELD (F[RANCES] M. L.). **The East African plant quarantine station.**—*Commonw. phytopath. News*, 1, 3, pp. 33–35, 2 figs., 1955.

At the newly opened East African Plant Quarantine Station at Muguga, Kenya, all importations of sugar-cane setts are grown for at least one year in separate metal-frame glasshouses, 20 by 6 by 7½ ft., fan ventilated, with slatted roller blinds; minimum temperatures are thermostatically controlled. Should mosaic virus [*R.A.M.*, 32, p. 669] or streak virus [loc. cit.] be discovered the affected plants are destroyed and contacts retained for a further year, but in the event of a disease unknown in the East African Territories developing all the plants are destroyed. All cane released is multiplied by the Uganda Department of Agriculture after preliminary heat treatment against ratoon stunting [34, p. 818].

Small importations of ornamentals which may be symptomless carriers of tomato spotted wilt virus [C.M.I. map No. 8] are now permitted, and these are tested separately for the virus by mechanical transmission to petunia. In the event of a single positive reaction all plants of that variety are destroyed, the remainder of the consignment being kept until a further negative result justifies release. Special precautions are taken with chrysanthemums.

BAWDEN (F. C.). **Plant pathology department.**—*Rep. Rothamst. exp. Sta., 1953*, pp. 83–96, 1954.

Some of the information in this report [cf. *R.A.M.*, 33, p. 584] has been noticed from other sources [34, pp. 442, 512, 778, *et passim*]. In further studies on the Rothamsted strain of tobacco necrosis virus [33, p. 702] F. C. BAWDEN and N. W. PIRIE found that preparations made by sedimenting the virus from freshly extracted sap were, weight for weight, less infective than those made by centrifuging sap aged for a day or so at room temperature. The sap probably contains an enzyme able to destroy infectivity without destroying the physical integrity of the virus particles. This enzyme is unstable in sap, but stable and active in partially purified preparations of the virus. The ratio of small to large particles in fresh, infective sap is much lower than was previously reported [30, p. 306].

Assays by B. D. HARRISON on extracts from leaves macerated at different times after inoculation with different viruses showed that there is first a period of decreasing infectivity, then one of rapidly increasing infectivity, which finally declines to

a progressively slower rate of increase. The shortest period after inoculation that elapsed before newly formed virus was detected varied with different hosts and viruses. At 20° to 25° C. it was ten hours for the Rothamsted tobacco necrosis virus in French bean [*Phaseolus vulgaris*], 24 hours in tobacco, and 40 hours for tobacco mosaic virus in tobacco and *N*[*icotiana*] *glutinosa*. Exposure to ultra-violet radiation indicated that those periods are probably at least twice the minimum required for new virus to form [33, p. 584]. The number of infections produced by the Rothamsted tobacco necrosis virus in French bean was halved by irradiation six hours after inoculation and in tobacco by irradiation after 20 hours, the same period being required for tobacco mosaic virus in tobacco. These periods are thought to represent the time required for the inoculum to multiply in the epidermal cells and new virus to pass thence to deeper cells, this movement occurring, apparently, before free virus can be detected in leaf extracts. With the Rothamsted tobacco necrosis virus the periods required for successive tenfold increases in infectivity of French bean leaf extracts, starting 19 hours after inoculation, were 3, 7, 10, and 19 hours. During the first day after inoculation multiplication was predominantly in the epidermal cells, but subsequently it was greatest in the chlorenchyma.

In studies by Marion A. Watson and Brenda M. G. Hamlyn on virus transmission by *Myzus persicae* and *Brevicoryne brassicae* [34, p. 762] the former aphid gave the higher number of infections of cabbage black ring spot virus when previously fasted and then fed for two minutes or less on infected plants. The numbers of *B. brassicae* transmitting the virus increased as the infection-feeding periods lengthened up to 30 minutes, after which they decreased. With brief infection-feeding periods more *M. persicae* than *B. brassicae* transmitted the virus, but at one hour or more the numbers were equal. *B. brassicae* ceased to be infective within two hours of leaving infected plants, whereas *M. persicae* remained so for six hours when fasted. More aphids of each species transmitted cauliflower mosaic virus after an infection-feeding period of an hour or more than after one of two minutes, though prior fasting increased the latter figures somewhat. *M. circumflexus* transmitted cabbage black ring spot virus from turnip to tobacco.

L. Broadbent and G. D. Heathcote report that in field experiments in conjunction with the National Agricultural Advisory Service cauliflower seedlings were protected from attack by virus diseases by narrow strips of barley, kale, and broad beans [see above, p. 147]. There was little spread of cauliflower mosaic or cabbage black ring spot viruses [34, p. 68] in the spring, as aphids were uncommon, but whenever the viruses occurred their incidence was decreased by the barriers, particularly of barley, and the seedlings grew better, with up to 10 per cent. more plantable ones. When 191 winged aphids migrating from plants infected with cauliflower mosaic were placed singly on turnip seedlings, 35 produced infection. Turnip yellow mosaic [33, p. 396] was diagnosed in several kinds of cruciferous crops, and caused much damage in Northumberland.

In experiments by Marion A. Watson to devise methods for assessing the relative susceptibility of sugar beet varieties to virus yellows [33, p. 586; 34, p. 693] 20 varieties were tested by colonizing lots of ten seedlings with one, five, or ten aphids [*M. persicae*]. Varieties derived from *Beta maritima* developed less severe symptoms than *B. vulgaris*, but both types were equally susceptible. Serological tests demonstrated that *B. vulgaris* plants contained more virus; *B. maritima* plants with more severe symptoms contained more virus than those with mild symptoms. Plants with slight symptoms in the greenhouse frequently became severely chlorotic in the open, though seedlings with severe symptoms sometimes recovered when grown outside.

R. Hull and J. W. Blencowe state that the available evidence indicates that the disease usually called 'yellows' in field crops of sugar beet may have more than

one cause. Many isolates caused yellowing but no etch [33, p. 460] or other necrotic lesions, and sap from plants infected with these consistently failed to react with antisera prepared against isolates causing necrosis. Electron micrographs of infected sap showed filamentous particles only when the plants had necrotic symptoms; sap from these precipitated strongly with antiserum. When infected with virus from plants with necrosis, beets with only yellowing developed veinal necrosis as quickly as did previously healthy plants. Plants so infected were more chlorotic and stunted than were plants infected with either isolate alone.

J. W. Blencowe reports that in nine field experiments in three localities between 1950 and 1953 only once did time of singling greatly affect the incidence of yellows. On that occasion there was an unusually early migration of aphids, and a much smaller proportion of the plants became infected on plots not singled than on the singled. Incidence was generally affected by date of sowing. In years when aphids arrived early, plots sown in March had more plants infected than had those sown in May. More often, however, the aphids arrived in late June or July, and then late-sown plots had more infected plants than the early-sown. Late singling decreased plant populations and yields unless rubbed or decorticated seed was used. Sowing in March generally gave the biggest yields, except when the weather caused 'bolting'.

Some of the information given by R. Hull and D. Osborne on the incidence of yellows in field beds of sugar-beet stecklings in the United Kingdom has already been noticed [34, p. 13]. In the north of England beds with exceptionally heavy aphid infestations had a mean of 4·1 per cent. infected plants; for beds in the eastern counties sprayed with insecticide the figure was 1·9, and for those grown under a cover crop and sprayed 1·3. Seven beds were rejected because they had over 1 per cent. infection in the autumn. Samples from six of these beds gave 6 to 63 per cent. infected plants. Nine beds passed for planting gave 5 to 10 per cent. infected 'seeders', three gave 10 to 15 per cent., and two 22 per cent. Most of these were from beds in the north.

According to L. F. Gates, as soon as the stecklings emerged at Dunholme they were colonized by many alate *M. persicae*, and none of seven insecticides used prevented the development of yellows [loc. cit.]. Early spraying probably gives poor results because little insecticide is absorbed by small seedlings; soaking the seed in systemic insecticide before planting or watering the solution on to the soil at emergence prevented colonization by aphids but decreased the stand. The effect of twice spraying root crops with systemic insecticides upon the incidence of yellows varied greatly from year to year and from crop to crop, according to the circumstances in which the particular outbreak occurred. When only a few plants are infected by invading infective aphids and most of the yellows results from secondary spread within the crop, then insecticides greatly reduce incidence. In such conditions, however, yield losses are small, and treatment, though it may decrease incidence by factors of from 2 to 5, is unlikely to be economically advantageous. When infection occurs early and many plants are infected by incoming aphids, all the plants on sprayed and unsprayed plots may become affected; then, spraying merely delays by two or three weeks the time when the crop becomes 100 per cent. infected. As, however, the yield of sugar is greatly reduced by early infections, this delay may be useful and spraying may give the greatest return.

R. Hull found three weeds to be susceptible to yellows virus. The leaves of infected *Senecio vulgaris* [cf. 35, p. 61] became yellow, thick, and brittle; passage through this host did not affect the type of symptoms produced in sugar beet by mild and virulent isolates. In one test with *Capsella bursa-pastoris* [loc. cit.] infected plants were stunted, but in another they remained indistinguishable from the uninfected; even when a virulent isolate was used the virus recovered produced only mild symptoms in beet. *Stellaria media* was symptomless, but sap reacted

strongly with virus antiserum. Isolates virulent to beet were recovered apparently unchanged by passage through this host.

The results of air spore trapping [33, p. 615] by P. H. Gregory, J. M. Hirst, F. T. Last, and O. J. Stedman in a wind tunnel [31, p. 251] indicated that spore liberation by *Erysiphe graminis* (on heavily infected wheat and barley) [34, p. 778] was independent of wind speed. Keeping the plants in constant light or in constant darkness for periods of up to 72 hours did not alter the diurnal periodicity.

F. T. Last reports that potato blight (*Phytophthora infestans*) [34, p. 56] was recorded at Rothamsted in 1953 on 23rd July; this was the earliest record since 1940. Spread was moderately rapid until September, when dry weather arrested it. When Majestic potatoes were given two well-timed copper sprays and the haulms were killed with sulphuric acid tuber yield was increased by only ½ ton per acre. A tractor sprayer with an eight-row boom passing through the crop three times reduced yields by 7 cwt. per acre. During the dry weather in September, the weight of tubers decreased by one ton per acre when the haulms died. This decrease occurred earlier on unsprayed than on sprayed plots; had harvesting been carried out when the haulms on the unsprayed plots were dead it would have appeared that spraying had increased the yield by 2 tons per acre.

In further work by Mary Glynne, G. A. Salt, and D. B. Slope on the effect of rotations on infection by eyespot (*Cercosporella herpotrichoides*) and take-all (*Ophiobolus graminis*) [33, p. 587], plots in which wheat was grown in 1953 as the first, second, third, or fifth consecutive crop of wheat (or barley) had 16, 47, 82, and 63 per cent. eyespot and 0·3, 24, 34, and 45 per cent. take-all, respectively.

The continuation of an experiment by G. A. Salt [33, p. 76] on a crop of wheat, the fourth in five years, is reported. The plants developed eyespot and take-all. Decreasing the seed rate from 3 to 1½ bush. per acre decreased take-all and increased the yield by 3 to 5 cwt. per acre. Ammonium sulphate at 0, 2, and 4 cwt. per acre increased the area of Squareheads Master lodged from 22 to 51 and 58 per cent., respectively, decreased take-all, and increased yield from 14 to 18 and 19 cwt. per acre. Cappelle did not lodge and with this variety the fertilizer decreased take-all and increased yield from 18 to 22 and 24 cwt. per acre. The reduced seed rate and a heavy dose of nitrogen combined to increase the yield of Squareheads Master from 12 to 22 cwt. per acre and Cappelle from 14 to 25 cwt. per acre.

Tillering was found to be important in determining the incidence of eyespot. In pots nitrogen applied between October and April increased tillering early and so delayed infection of the straws, the lesions being less severe at harvest; nitrogen in May induced tillering too late to prevent the principal straws from becoming infected. In the field the effect of the nitrogen in delaying infection was counteracted by increasing the luxuriance of the crop which favoured the fungus. Nitrogen applied in October gave more tillers and fewer severe lesions at harvest than applications in March, April, or May.

Mary Glynne states that eyespot is the most important of the foot- and root-rotting diseases in the four- and six-course rotation experiments at Rothamsted. In the four-course an average of 45 per cent. straws were infected at harvest during the years 1938 to 1953 (range 3 to 86 per cent.), and in the six-course 29 (2 to 80) per cent.

L. F. Gates reports that diseases of seedling sugar beets caused by *Phoma betae* [34, p. 692] present in the seed or by soil fungi were greatly reduced by 1 per cent. phygon dust, soaking for 20 minutes in ethyl mercury phosphate solution (40 p.p.m. active material), and by 0·5 per cent. dow 9 B dust. Fungicidal dressing was most effective when the crop was sown early.

Plant pathology division.—*Res. & exp. Rec. Minist. Agric. Nth. Ireland*, 3 (*1952–53*), pp. 208–216, 1955.

In this report [cf. *R.A.M.*, 34, p. 573] it is stated that the following species of

Fusarium have been isolated from oat seed in Northern Ireland: *F. avenaceum*, *F. graminearum*, *F. culmorum*, *F. nivale* [*Calonectria nivalis*], *F. solani* var. *minus*, *F. acuminatum*, and *F. poae*. Of 200 isolations from the 1951 oat crop in all counties 50 per cent. were of the *F. avenaceum* type, 30 of *F. graminearum*, and 5 of *F. culmorum*. It was shown that strains of varying pathogenicity exist within single species of *Fusarium* on seed oats. All the species were pathogenic to young seedlings. The development of *F. graminearum* was favoured by dry conditions in both field and pot tests.

Complete control of *Colletotrichum linicola* on flax [28, p. 173; 34, p. 367] may be achieved by seed treatment with a fungicide such as nomersan [20, p. 535], but similar control of other seed-borne organisms was not obtained, although their incidence was lessened.

The oil flax variety La Plata, resistant to *C. linicola*, *Polyspora lini* [28, p. 173], *Melampsora lini* [34, p. 648], and *Phoma* sp. [31, p. 593], was crossed with a Russian fibre variety, Textilshchik, resistant to *M. lini* but susceptible to most other diseases. Progeny of some subsequent back crosses were resistant to *Polyspora lini*.

Most of the results of an investigation of the factors affecting club root [*Plasmodiophora brassicae*: 34, p. 422] of cabbage have already been noticed [33, p. 573]. Serious attacks were found to be possible in contaminated soil of pH as high as 8·2.

In a summer spraying test for the control of rose rust [*Phragmidium mucronatum*: 13, p. 98] adequate control was achieved by $\frac{1}{2}$ per cent. and $\frac{1}{4}$ per cent. oil-Bordeaux mixture, white oil and colloidal copper, a mixture of wettable sulphur and fermate, and sprays based on thiram and zineb, applied fortnightly between May and September, 1952. Dwarfing and defoliation of the bushes was, however, caused by the sprays containing copper and zineb. The plot treated with thiram appeared the healthiest and was left untreated until July, 1953, when rust was spreading well in the unsprayed plots. From then until the end of August portions of it were sprayed with thiram and thiram plus fermate at seven- to ten-day intervals. Unsprayed bushes were almost completely defoliated while the sprayed ones developed only slight infection. Further experimental evidence indicated that spraying need not begin before the end of April.

The section dealing with the health of seeds and plant stocks (p. 212) refers to the continuation of the work to establish virus-free foundation stocks of potatoes [34, p. 574]; tubers of the varieties Ulster Chieftain, Ulster Ensign, Ninetyfold, and Arran Pilot showed no virus reaction.

Examination of 1,224 samples of English flax seed in 1952 and 1953 revealed that the commonest fungus contaminant was *Botrytis cinerea*.

The average percentage contamination of rye grass [*Lolium perenne*] seed with *Phialea temulenta* [23, p. 228] in 1952 was 28·5 in the variety S 24 and 9·5 in Devon Eaver. Infection in 1953 was lower, but again greater in S 24.

In the section dealing with advisory work (p. 215) it is recorded that outbreaks of potato wart [*Synchytrium endobioticum*] were confirmed in three new localities in 1952. Crown rot of fodder beet, due to boron deficiency, was again noted. The most conspicuous disorder of soft fruits was June yellows [*R.A.M.*, 34, p. 604] in the strawberry variety Auchincruive Climax. Two new tomato varieties from the John Innes Horticultural Institute, Antimold A and B, showed outstanding resistance to leaf mould (*Cladosporium fulvum*) [31, p. 593] in the field.

Two new records for Ireland were *Chrysomyxa rhododendri* on the rhododendron Rosy Bell and *Heteropatella valtellinensis* on carnations [cf. 32, p. 482].

McKay (R.). **Some unusual parasitic and non-parasitic diseases of plants observed in Ireland in 1953**—*J. Dep. Agric. Eire*, 50, pp. 151–155, 9 pl., 1953–54.

In July, 1953, Ebenezer onions growing in County Cork developed up to 15 per

cent. infection by *Fusarium* spp. In April, 1953, the greater part of a bed of anemones was killed off by *Sclerotinia tuberosa* [cf. *R.A.M.*, 26, p. 407], not previously recorded by the Department. In greenhouses in which tomatoes were being sprayed against *Cladosporium fulvum*, 10 per cent. of the fruits displayed roughness and discoloration caused by the spraying. A number of cases of failure or partial failure of wheat, barley, and oats to establish satisfactory stands after sowing in the spring of 1953 were traced to injuries caused by seed dressings. Such damage is closely related to the moisture content of the grain: this was high in the autumn of 1953 and was probably an important factor in some very bad failures of grain sown in November.

Åkerman (Å.). **Årsberättelse över Sveriges Utsädesförenings verksamhet år 1953.** [Annual report on the work of the Swedish Seed Association for the year 1953.] —*Sveriges Utsädesfören. Tidskr.*, 65, 2, pp. 111–187, 1 graph, 1955.

This report contains, *inter alia*, the following information of phytopathological interest [cf. *R.A.M.*, 34, p. 19]. The luxuriant growth of winter wheat at Svalöf during the exceptionally warm autumn of 1953 predisposed it to heavy infection by *Erysiphe graminis* [see below, p. 175] and to a lesser extent by *Fusarium nivale* [*Calonectria nivalis*, see below, p. 155], which in turn led to a serious reduction of winter-hardiness, especially in the Sammetsvete, 01473, and Trifolium 14 varieties. The central-Swedish Odin, 01395, Virtus, and Aros showed a satisfactory measure of resistance to mildew, and overwintered well. Odin also proved highly resistant to *E. graminis* and *C. nivalis* at Kalmar, where the foreign varieties Titan, Heine VII, and Capelle Desprez sustained extensive injury. Heavy rain and strong winds in July contributed to severe damage from lodging at Svalöf, associated with infection by *Fusarium*, *Septoria*, *Alternaria*, and *Cladosporium* spp.

The summer wheat crop was also reduced to some extent through infection by *E. graminis*, *F.*, *S.*, and *C.* spp., mostly involving the late varieties. The highest yields were given by Rival, Fylgia II, Kärn II, and the early Norwegian Fram II and Norröna.

The experimental plots of winter barley in Östgöta were decimated by *E. graminis*.

An outbreak of *A. [solani]*, normally unimportant in Sweden, threatened to destroy the late potato crop but was effectively combated by spraying with copper-lime. *Phytophthora [infestans]* was epiphytotic at the beginning of August, attacks on the Robusta variety being observed for the first time on the experimental plots at Svalöf, Ugerup, and Borrestad. A high degree of resistance was characteristic of selections with *Solanum demissum* in their ancestry [cf. 34, p. 393 *et passim*]. Infection by potato virus X was abnormally severe, causing extensive malformation of the plants in certain varieties. The results of serological tests performed with antisera of viruses X and S [34, p. 389] obtained from Holland indicated that the former was more prevalent in Sweden than hitherto believed and the latter present in significant amounts. The incidence of leaf roll virus was also high following its wide dissemination in 1952.

Outbreaks of *P. infestans* on potato were also reported from other branches of the Association. At Ultuna the maximum yield of 42 tons per ha. was produced by the Dianella variety. Blight is becoming increasingly destructive in Västernorrland, and a continuance of this trend would necessitate the introduction of more resistant varieties, since the numerous smallholders occupying the region cannot be expected to undertake large-scale spraying operations. In Jämtland the Early Puritan and Bintje varieties were severely attacked: Up-to-Date and two Svalöf selections gave the highest yields. The losses in Värmland were also very heavy, tuber rot being prevalent except in certain varieties, e.g., Eva, Majestic, and Svalöf 46107.

Second year red clover stands near Linköping, Östgöta, sustained damage from

rot [*Sclerotinia trifoliorum*: see below, p. 192], to which Merkur and the higher-yielding Og 044 were significantly more resistant than Monark and Hersnap. Vg 035, a selection from a cross between Merkur and Resistenta, was equally satisfactory, while the best lines were derived from Merkur, Sv045, and C057. As usual, a number of tetraploid strains were outstanding in respect of both yield and resistance [34, p. 19]. At the Ultuna branch Merkur elite D and more especially E were markedly superior to the variety itself. In the same locality field crops of broad beans were prematurely defoliated by *Botrytis* sp., with a resultant reduction of yield in the Primus variety.

Jamalainen (E. A.). **Fusarium species causing plant diseases in Finland.**—*Acta agral. fenn.*, **83**, pp. 159–172, 1955.

Some of the information in this account of the fusarioses of economic crops in Finland has already been noticed from other sources [*R.A.M.*, 32, pp. 239, 412; 33, pp. 664, 743]. The following additional items may be mentioned. *Dactylis glomerata* is fairly susceptible to *Fusarium nivale* [*Calonectria nivalis*], the principal cause of winter injury, while the more resistant grasses include *Alopecurus pratensis*, *Poa* sp., and *Festuca rubra*.

The importance of *Fusarium* spp. in the reduction of germination and tillering of peas was clearly demonstrated by observations at the Agricultural Research Centre, Tikkurila, over the period from 1944 to 1953, the most harmful species in inoculation experiments being *F. anguioides*, *F. avenaceum*, *F. bulbigenum*, and *F. culmorum*.

The examination in 1938 of numerous samples of potato tubers from different parts of the country revealed a generally low incidence of *F. caeruleum*, which may, however, cause considerable damage under warm, dry storage conditions in cities. On the other hand, *F. merismoides* occurred in great abundance.

F. avenaceum is responsible for an apple disease known as brown heart, which is particularly troublesome on the widely cultivated Åkerö variety. The flesh round the core turns brown and a white or pink mould develops on the inside of the carpel walls. Infection originates on the tree and continues in the stored fruit.

Several *F.* spp. were isolated from conifer (mostly spruce) seedlings in 1938 and 1939, including the pathogenic *F. arthrosporioides*, *F. avenaceum*, and *F. sambucinum*.

Thirty-fifth Report of the Quebec Society for the Protection of Plants, 1953.—79 pp., 1 pl., 24 figs., 3 graphs, 1 map. 1954. [Received 1955.]

In this report [cf. *R.A.M.*, 34, p. 135] E. Lavallée (pp. 47–49) gives [in French] the results of fungicide trials at St Martin against tomato blight [*Phytophthora infestans*: see below, p. 158] and anthracnose [*Colletotrichum phomoides*: cf. 34, p. 407]. Blight was not very serious: seven applications of COCS (4 lb. in 100 gals.) kept the plants free from blight while most of the picking was being done, though there was 40 per cent. infection in the untreated. In the following 18 days blight spread but did less damage on the copper-treated plots than on the untreated: foliage was in better condition and the percentage of affected fruit 5·4 as against 19·7 in the unsprayed. Zerlate was added to control anthracnose, but incidence was slight. It was not very effective against blight, control depending upon the amount of copper used.

The work by K. M. Graham and H. N. Racicot (pp. 50–54) [given in French, with English summary] on 31 isolates of biologic races of *P. infestans* from potato tubers in eastern Canada has already been reported briefly [34, p. 809 and below, p. 217]. Three races were differentiated, race 1 or A attacking Green Mountain potato and Stokesdale tomato only; race 2, pathogenic to the foregoing, cherry

tomato (Geneva T-5), and Jamaica Wild, both resistant to race 1; and race 3 attacking Canso, Keswick, and Kennebec potatoes. The authors believe a numerical system of classification [cf. 33, p. 251] to be more suited than an alphabetical one to accommodate unforseen gene combinations or different modes of inheritance likely to be encountered in races not yet discovered.

J. Ringuet and L. Cinq-mars (pp. 55–58) give [in French] a list of raspberry diseases in Quebec [34, p. 305] for which nurseries are regularly inspected and certified. The certification scheme, started in 1949, requires that plants should have no more than 2 per cent. infection with mosaic virus at the first inspection and 0·5 per cent. at the second. These investigations have disclosed that the varieties Trent and Chief are very resistant, and Newbury and Herbert fairly so. Plantations with more than 10 per cent. crown gall (*Agrobacterium tumefaciens*) are condemned.

Yellow rust (*Pucciniastrum americanum*) is of frequent occurrence in nurseries, particularly on Viking and Newbury, the two principal varieties. However, this and other diseases do not constitute an obstacle to certification. In 1952 there were six varieties in the scheme, grown on 14 certified properties, and the general health of plantations has, in consequence, improved considerably.

J.-E. Jacques (pp. 59–60) describes [in French] the influence of certain media on the growth in liquid culture of *Trichoderma lignorum* [*T. viride*: 34, p. 383], found growing on phlox roots in nutrient culture. On Hoagland and Arnon's nutrient solution the fungus survived without growth or sporulation; maltose stimulated both, while dextrose gave the most prolific growth, but poor sporulation, the latter being best on malt extract.

Report of the Minister of Agriculture for Canada for the year ended March 31, 1955.—166 pp., 1955.

In the section of this report [cf. *R.A.M.*, 32, p. 664] dealing with forest investigations it is stated that preliminary analyses of balsam fir [*Abies balsamea*] stands, averaging 59 years of age, in south-eastern Quebec, indicated that 43 per cent. were infected with trunk and butt rot [unspecified]. In the 80- to 89-year stands 40 per cent. of the merchantable volume was culled for pulpwood. In the same plots the cull volume in 75-year-old red spruce [*Picea rubens*] was only 13 per cent. Decay in this region was three times more severe than in the Quebec City and Laurentide Park areas. Premature mortality of spruce in Saskatchewan was associated with soil conditions preventing downward penetration of the roots, predisposing the overcrowded roots to disease.

The examination of 9,000 young white pine [*Pinus strobus*] trees from seed collected in Ontario, Quebec, and the north-eastern States showed that the incidence of needle blight [cf. 33, p. 693] varied with the seed source, suggesting that the disease may be influenced by a combination of inherited characteristics and environment.

A fungus associated with most of the red stain infections in lodgepole pine [*P. contorta* var. *latifolia*] in Alberta was tentatively named 'unknown L'. Infections originating from 33-year old fire scars were responsible for 46 per cent. of the decay volume in the trees examined.

The dying of two species of birch in Quebec and neighbouring provinces has been correlated with a definite increase in both yearly and summer mean temperatures over the past 30 years [34, p. 408]. Three hot years from 1937 to 1939 followed by a second very hot summer in 1948 were fatal to extensive birch stands. During the cold, wet summer of 1954 25 per cent. of about 4,000 cultures attempted from mycorrhizal birch rootlets were successful compared with 8 per cent. in 1953.

The leaf and twig blight of poplars in Ontario, formerly attributed to *Didymosphaeria populina* [cf. 31, p. 39], was found to be due to a complex of organisms

attacking several species of poplar. *D. populina* appears to be restricted to balsam and cottonwood poplars [*Populus balsamifera* and *P. deltoides*].

Dutch elm disease [*Ceratostomella ulmi*: 34, p. 681] continued to be very destructive in Quebec. No immunity has been found in native elms.

In the section devoted to field crops (pp. 23–38) it is noted that in western Canada the most severe epidemic of rust [*Puccinia triticina* and *P. graminis*: 34, pp. 286, 628] in its history affected the wheat crop in 1954. This was due to the lateness of the crop, the early arrival of inoculum blown from Kansas and southern Nebraska in the first week of June, abundant rainfall, and the susceptibility of most varieties to *P. graminis* race 15 B and *P. triticina*. The latter was estimated to have caused more damage than *P. graminis* and the total loss in the epidemic was 135,000,000 bush. Two biotypes of race 29 and one of 15 B, though rare, proved virulent to the new variety Selkirk [34, p. 629]. A biotype of race 48 attacked McMurachy [34, p. 628] but not its descendant Selkirk, which contains the H 44 type of resistance.

In field experiments in Ontario less than 10 per cent. infection developed in winter wheat sown on 12th September in soil infested with dwarf bunt [*Tilletia controversa*: 35, p. 8] compared with 50 to 80 per cent. in the plots seeded on 1st October. Infection in later sown crops was increased by scattering bunt spores on the soil after sowing.

Loose smut of wheat [*Ustilago tritici*: 34, p. 432] was more prevalent in Manitoba, chiefly due to the increasing acreage of the susceptible variety Lee [35, p. 6]. A more promising degree of control was obtained by soaking infected Lee seed in 0·1 per cent. spergon for 24 to 56 hours at room temperature than under the same conditions in water [cf. 34, p. 590].

The root rot of winter wheat in Ontario associated with *Rhizoctonia* [*Corticium*] *solani* and the nematode *Pratylenchus minyus* [34, p. 778] was controlled to some extent by the application of thiram at seeding time.

Heavier losses in southern Alberta were experienced from wheat streak mosaic virus [34, pp. 588, 628] than in the previous two years. Cultures of ergot [*Claviceps purpurea*: 34, p. 629] collected from a number of cereal and grass hosts in western Canada were all able to infect wheat, barley, and rye. No evidence was obtained of the existence of different races of the fungus in this area.

Considerable damage to barley in Manitoba was caused by *Helminthosporium sativum* [34, p. 433], *H.* [*Pyrenophora*] *teres* [34, p. 23], and *Septoria passerinii* [34, p. 433]. Trial plots inoculated with *S. passerinii* suffered a 20 per cent. loss in yield compared with uninoculated plots.

In work on the production of barley free from smut [*Ustilago* spp.] at Kelvington, Saskatchewan, treatment with an organic mercury fungicide following the hot water soak [34, p. 590] improved germination by about 5 per cent. A greater reduction in yield was caused by barley stripe mosaic [barley false stripe virus: 34, p. 222] in irrigated than in dry land. At soil temperatures of 15° and 20° C. fewer inoculated barley plants displayed symptoms than at higher or lower temperatures.

Greenhouse tests have proved valuable for the rapid preliminary screening of lucerne varieties for resistance to wilt [*Corynebacterium insidiosum*: 34, pp. 459, 791]. The bacterium remained viable for eight years in lucerne hay stored at room temperature. Lucerne plants inoculated with the low-temperature basidiomycete causing snow mould [33, p. 430] on 15th September were severely damaged by hydrogen cyanide, while those inoculated on 15th November were undamaged.

The reduction in yield of soy-beans in Ontario in 1954 was attributed to manganese deficiency [cf. 34, p. 568]; improvements were reported by growers using manganese sprays.

At Ste. Anne de la Pocatière, Quebec, the roots of dandelions [*Taraxacum*

officinale] and ragweed [*Senecio jacobaea*] from infested fields were found to harbour the pathogen causing downy mildew of sunflowers [*Plasmopara halstedii*: 34, p. 629].

Following three years' trials in Prince Edward Island, maneb is recommended for the control of potato late blight [*Phytophthora infestans*: loc. cit.]. The growth of *P. infestans* in culture was inhibited by streptomycin and dihydrostreptomycin. In the greenhouse dihydrostreptomycin sprays protected potato plants from attack by *P. infestans*.

In studies on potato scab [*Actinomyces scabies*: 34, p. 244] it was shown that stolons of the susceptible variety Katahdin stimulated bacteria and fungi in soil in contact with them, whereas only fungi increased in soil on stolons of the resistant variety Ontario. Tubers and roots of both varieties stimulated the microbial population of the soil.

Certain strains of *Solanum demissum*, *S. bulbocastanum*, *S. stoloniferum*, and *S. polyadenium* used for breeding were immune from the lethal race 1,2,3,4 of *P. infestans* [see below, p. 217].

A scheme was initiated in New Brunswick for multiplying virus-free stocks of new potato seedlings.

In further studies on the potato witches' broom virus in British Columbia [34, p. 609] similar symptoms were induced in potatoes inoculated with strains 1, 2, or 3 of the virus, singly or in combination. In tomato the symptoms induced by a mixture of strains were caused partly by each component. In *Cyphomandra betacea*, however, only one strain in a mixed inoculum was able to multiply sufficiently to produce symptoms, strain 2 being dominant.

The best control of tomato late blight [*P. infestans*: 32, p. 615] was achieved with manzate, tricop, and COCS-55, but the last was slightly phytotoxic. *Septoria* leaf spot [*S. lycopersici*: 30, p. 16] was controlled by the same treatments.

Three races of club root [*Plasmodiophora brassicae*] have been differentiated in Canada: race 1 attacks Wilhelmsburger swede and tumbling mustard [*Sisymbrium altissimum*], while race 2 is non-pathogenic to these, and race 3 infects the latter but not the former. The club root-resistant cabbage, 8351–T, developed in the United States, was very susceptible to races 2 and 3 but only slightly so to race 1.

Fungicides containing captan gave outstanding control of apple scab [*Venturia inaequalis*: 34, p. 629] in Nova Scotia during 1954. Organic mercury eradicant fungicides also gave good control. In south-western Quebec merculine and fixtan were superior to C.I.L. mercurial apple spray. Cankers of *Erwinia amylovora* on apple [cf. 35, p. 25] and pear [cf. loc. cit.] were controlled by streptomycin (500 p.p.m.). Three bloom applications of streptomycin (40 p.p.m. agri-strep) in one test resulted in 69 spur and twig infections of *E. amylovora* compared with 214 where dithane Z-78 was used.

Following the application of insecticides for eight seasons to cherry trees in Creston valley, British Columbia, only five trees became infected with little cherry virus [33, p. 708].

Concentrate sprayers delivering air at velocities greater than 100 m.p.h. gave better deposits in the tops of mature apple trees than those with a lower capacity in tests in British Columbia. In Ontario reducing the fungicide in concentrate spraying by 20 per cent. did not decrease the efficiency of scab control.

Soil applications of manganese sulphate to fruit trees suffering from manganese deficiency in the Okanagan Valley [33, p. 708] increased the manganese content of the leaves but had no effect on the deficiency symptoms. These were cured in 30 days by manganese foliage sprays.

The food preservative sorbic acid [34, p. 801], at concentrations of 0·05 to 0·1 per cent., prevented the growth of [unspecified] moulds and yeasts in maraschino cherries, apple juice, apple sauce, and olives but induced undesirable flavour and oxidation at the higher rate.

Fungicidal paints containing diphenyl mercury dodecenyl succinate applied to the walls of apple storage rooms reduced the number of micro-organisms. In laboratory tests the zone of inhibition for each paint was measured against a number of test organisms [unspecified].

Verticillium wilt of strawberry [*V. albo-atrum*: 32, p. 667], newly reported from Vancouver Island and the Fraser Valley, British Columbia, caused heavy losses. A rapid method for distinguishing between strains of the strawberry red stele fungus (*Phytophthora fragariae*) [34, p. 433] was evolved at Saanichton, British Columbia, by testing the isolates against seedlings of strawberry, spinach, tobacco, and tomato grown aseptically and placed on agar cultures of the fungus. The strains differed in their attack on these hosts. It was shown that some isolates of *P. cactorum* were more pathogenic to strawberry than *P. fragariae*. *Dendrophoma obscurans* [33, p. 738] rotted injured strawberries at all stages of maturity, whereas *Gnomonia fructicola* [33, p. 737] attacked only mature berries. Brown rot (*Botrytis cinerea*) [33, p. 738] of strawberries in Nova Scotia was controlled by captan.

In Vancouver Island leaf spot of loganberry (*Mycosphaerella rubi*) was effectively controlled by a dormant spray of lime-sulphur followed by three applications of ferbam in April, May, and June.

The most frequent isolate from poplar was *Corticium polygonium* [32, p. 520], comprising 180 out of 493 isolates. *Gloeocystidium karstenii*, secured for the first time from decays, was isolated 33 times from poplar and ten from birch.

In the Soil Science Department *in vitro* studies with *Pseudomonas viscosa* isolated from wheat indicated that it possesses greater antibiotic properties against *Helminthosporium sativum*, *Fusarium culmorum*, and a number of Gram-positive and Gram-negative bacteria than *P. aeruginosa*, *P. fluorescens*, or *P. chloroaphis*.

Preliminary results from work on the metabolism of five genera of plant pathogenic bacteria [34, p. 438] indicated that certain members of *Xanthomonas*, *Pseudomonas*, and *Agrobacterium* possess a 6-phosphogluconate-splitting system while *Erwinia* and *Corynebacterium* do not. The *Erwinia* species tested attacked glucose by the glycolytic as well as the oxidative pathway but those species of *Corynebacterium* under observation were unable to ferment the sugar.

Among plant diseases intercepted in Canada during the period under review were *Rhizopus* on lily bulbs from Japan and leaf rust [? *Cumminsiella sanguinea*] on *Mahonia* from Holland.

Approximately 85 per cent. of the 60,000 acres of potatoes entered for seed certification in 1954 were passed, compared with 79 per cent. of a slightly lower acreage in the preceding year. The diseases most commonly responsible for rejections were bacterial ring rot [*C. sepedonicum*: 34, p. 537] in 295 crops, mosaic [viruses: 33, p. 466] in 357, leaf roll [virus: 34, p. 429] in 129, and black leg [*Erwinia carotovora*: 33, p. 466] in 360.

The Cereals Crops Division records that the average infection with dwarf bunt in 73 resistant wheat varieties in a special nursery in Ontario was 6 per cent., compared with 14 per cent. in the susceptible Cornell 595 [34, p. 432].

In an extensive screening of foreign flax varieties none was found resistant to pasmo [*Mycosphaerella linorum*: 34, p. 433].

The oat varieties Rodney [34, p. 432] and Garry 27 gave good results in the northern oat belt of the United States, but not in the Maritime Provinces, and did well under severe rust conditions. Improvement in rust resistance of the oat variety Beaver was achieved by back-crossing.

The forage crops division reports that clover northern anthracnose [*Kabatiella caulivora*: cf. 34, p. 236] was increasingly prevalent in Alberta. The yield and quality of hay of 12 varieties of red clover in comparative tests was reduced by 50 per cent. as a result of infection. Seed yield was similarly affected by the flowers on infected stems wilting or becoming detached. Only 230 of 4,400 plants of

Siberian red clover were comparatively free from infection in 1954. Some selections from the varieties Dollard [loc. cit.], Ottawa, and Siberian showed good resistance to both northern anthracnose and powdery mildew [*Erysiphe polygoni*: cf. 34, p. 438].

A new strawberry seedling, F 487 from Sparkle × Valentine, showing freedom from leaf spot [*Mycosphaerella fragariae*: 33, p. 738], is described in the horticulture section. F 489 from the reciprocal cross yielded less than F 487 and was also free from *M. fragariae*.

At Ottawa tests were carried out on the storage of McIntosh apples at 30° F. instead of 32°. Both [unspecified] fungal and physiological wastage were reduced at the lower temperature. [Unspecified] mould growth in strawberries was reduced by trichloroethylene vapour (1 in 20,000). At 71° the mould-free period was increased by one third and at 40° was doubled by this treatment.

In tobacco-breeding activities at the Harrow Laboratory, the Burley varieties Harrow Velvet [34, p. 492] and Burley 1 were more prolific and highly resistant to black root rot [*Thielaviopsis basicola*: loc. cit.]. The first heavy-bodied *T. basicola*-resistant Burley variety to compare favourably with Green Briar has been bred from Green Briar × Kentucky 41 and is named Improved Briar; its release in 1955 was expected.

Further information of phytopathological interest in this report has been dealt with from other sources [34, pp. 628, 680, *et passim*].

CONNERS (I. L.). **Thirty-fourth Annual Report of the Canadian Plant Disease Survey, 1954.**—xx—140 pp., 4 figs., 1 map, 1955. [Mimeoprinted.]

Some of the information given in the section of this report [cf. *R.A.M.*, 34, p. 628] dealing with new or noteworthy diseases (pp. ii–v) [also given in French] has already been noticed [see preceding abstract]. The susceptibility of wheat varieties grown in western Canada to the prevailing races of leaf and stem rust (*Puccinia triticina* and *P. graminis*) [loc. cit.] is emphasized, as increasing losses are being suffered, especially in durum wheats. In Ontario several of the winter wheat areas were affected by dwarf bunt (*Tilletia controversa*) [loc. cit.], while eye spot (*Cercosporella herpotrichoides*) [30, p. 307] was found in several fields. A virus disease of wheat, oats, and barley in Alberta may be caused by the cereal yellow dwarf virus [33, p. 74].

The replacement of Grimm lucerne in southern Alberta by Ladak, partially resistant to bacterial wilt (*Corynebacterium insidiosum*) [see preceding abstract], lessened the destructiveness of the disease. The occurrence of *Gloeosporium spadiceum* on red clover in Quebec constituted a new record for eastern Canada. Downy mildew of sunflower (*Plasmopara halstedii*) [loc. cit.] was more severe during the period under review.

Phytophthora megasperma caused a new field rot of carrots [cf. 32, p. 413] in British Columbia.

The incidence of bacterial ring rot (*Corynebacterium sepedonicum*) on potato [see preceding abstract] depended upon the control measures taken by various provincial authorities. Blight (*Phytophthora infestans*) [loc. cit.] was present on potato in every province for the third year in succession. The new European latent virus disease, caused by potato virus S [cf. 34, p. 807], was detected serologically in Green Mountain potato plants at Fredericton, New Brunswick.

During 1953 pear blast (*Pseudomonas syringae*) [34, p. 793] was epidemic in the Saanich peninsula, British Columbia, but was less prevalent in 1954. Strawberry red stele (*Phytophthora fragariae*) [see preceding abstract] was found for the first time in the Niagara peninsula.

Among new records of interest on trees and shrubs were the leaf-spotting fungi

Marssonina betulae on birch (*Betula papyrifera*), a new record for North America, and *Actinopelte dryina* on oak (*Quercus borealis*), a new Canadian record.

In a greenhouse at Regina, Saskatchewan, chrysanthemum topple (non-parasitic) was severe. New Canadian records on ornamental plants included *Xanthomonas oryzae* var. *dianthi* on carnation [33, p. 724], *Septoria lythrina* on the *Lythrum* variety Morden Pink, and *Cryptosporium minimum* on rose [cf. 14, p. 171].

Reports of the Science Laboratories.—*Nat. Res. Coun. Rev., 1954*, pp. 35–171, 10 pl., 1955.

In the section of this review dealing with mycological investigations at the Prairie Regional Laboratory, Saskatoon, Saskatchewan, Canada [cf. *R.A.M.*, 32, p. 541], G. A. Ledingham (pp. 52–53) states that better survival of fungi in the culture collection was secured by using the centrifuge-drying technique [33, p. 245], owing to the less severe freezing temperatures and more rapid warming to laboratory temperature than in other techniques. Plants of sunflower, safflower, and flax infected with rust [*Puccinia helianthi*, *P. carthami*, and *Melampsora lini*, respectively] were raised in pure culture in flasks. Uredospores produced on these plants were of low vitality. An increase in the nitrate concentration in the culture medium resulted in more widespread rust infection in sunflower. Detached safflower leaves floating on a medium were infected with *P. carthami* [34, p. 321].

A strain of smut fungus [*Ustilago* sp.] producing 18 gm. ustilagic acid per l. [32, p. 542] in less than 24 hours on a substrate containing 7·5 per cent. sugar has been released for commercial use.

Sixth Annual Report of the Commonwealth Scientific and Industrial Research Organization for the year ending 30th June, 1954.—Canberra, 179 pp., 1954. [Received 1955.]

In the plant section (pp. 19–34) of this report [cf. *R.A.M.*, 34, p. 433] it is stated that in inoculation experiments with *Phytophthora infestans* on leguminous plants (*Acacia*, *Cassia*, and *Erythrina* spp.) indigenous to arid regions of Australia the parasite penetrated the leaf epidermis, but was checked by a severe 'defence' reaction. Systemic absorption of streptomycin by potato and tomato plants prevented the development of *P. infestans* after infection and caused a change in the reaction of the various plant organs, which reacted differently; the effect on leaves increased with decreasing age. The antibiotic gave no general protection against fungal pathogens nor did treatment with high concentrations for long periods prevent infection of potato plants by powdery mildew [*Erysiphe cichoracearum*]. Streptomycin was readily absorbed from nutrient solutions by tomatoes and became evenly distributed throughout the plant, but with marked phytotoxicity. When applied as sprays over a long period it was not toxic.

P.A.C.A. (phenylaminoacadmium acetate) proved superior to actidione in controlling dollar spot of turf [*Sclerotinia homoeocarpa*: 31, p. 609].

Observations on the differences in the incidence of brown rot of peaches [*S. fructicola*: 34, p. 794] in the Goulburn and Murray river valleys, Victoria, suggest that they are mainly due to soil moisture differences in sandy soils and loams. In waterlogged soils brown rot is destructive, but is negligible in loams of low permeability.

Soil from Katherine, Northern Territory, caused frenching of tobacco [34, p. 434] under glasshouse conditions at Canberra. Symptoms appeared earlier at a soil temperature of 35° C. than at lower ones and were delayed by high soil nitrogen. Soil treatments with nine trace and some major elements had no effect on incidence, but control was obtained with a low soil water content in the glasshouse. Six bacterial isolates from Katherine soils failed to produce frenching in plants grown aseptically on agar or in sterilized soil, but soil filtrates and washed sand retained

their ability to induce symptoms. In field tests at Katherine frenching occurred in furrow-watered but not in spray-irrigated plots; high ridging of plants also reduced the incidence. Although blue mould of tobacco [*Peronospora tabacina*: loc. cit.] has been kept under control in seed-beds by benzole for 20 years this does not prevent field infection. Trashy leaf [loc. cit.], occurring in soils rich in organic matter, especially ploughed-in legumes, still causes losses of tobacco in northern Australia.

New plant diseases.—*Agric. Gaz. N.S.W.*, 66, 6, p. 312, 1955.

New disease records for New South Wales during the six months ending 31st December, 1954 [cf. *R.A.M.*, 34, p. 706; 35, p. 2] include *Botrytis allii* on onion; *Agrobacterium tumefaciens* and *Cercospora beticola* on fodder beet; beet mosaic virus on silver beet; *Sclerotinia sclerotiorum* and *Botrytis cinerea* on *Hibiscus cannabinus*; *Peronospora tabacina* on *Nicotiana glutinosa* and *N. sylvestris*; *Itersonilia* sp. [cf. 33, p. 298] on parsnip; tomato spotted wilt virus and cucumber mosaic virus on *Centaurea cyanus*, the former also on *Delphinium ajacis*; and *Verticillium dahliae* on *Digitalis lanata* and *Eucalyptus citriodora*.

Neveling (C. H.). **Report of the Secretary for Agriculture for the year ended 31 August, 1954.**—*Fmg in S. Afr.*, 30, 348, 124 pp., 1 fig., 1955.

In the Plant Pathology section of this report from South Africa [cf. *R.A.M.*, 33, p. 657] J. E. van der Plank states (pp. 123–124) that *Puccinia polysora* was found attacking maize on the Zululand coast [C.M.I. map No. 237]. Passion fruit [*Passiflora edulis*] near the Natal coast needed fortnightly spraying to control brown spot (*Alternaria tenuis*), leaf scorch (*Gloeosporium passiflorae*), and *Septoria* leaf spot (*Septoria passiflorae*) [*R.A.M.*, 16, p. 368]. Copper oxychloride and zineb were compared on Up-to-Date, Monak, and Alpha potatoes in Natal for the control of blight (*Phytophthora infestans*) [34, p. 669], 11 applications of each fungicide being made with a tractor-mounted, low-volume spraying machine. The season was wet and blight so severe that unsprayed Up-to-Date barely yielded the weight of the seed planted, and even after spraying gave only 35 bags per morgen (2·3 tons per acre). In bad blight areas spraying is justified only with tolerant varieties, such as Monak and Alpha, but Up-to-Date repays spraying only when blight is mild.

A disease of cannas characterized by chlorotic streaks and spots along the veins is caused by the [tomato] spotted wilt virus and is becoming increasingly prevalent in the Pretoria area. Evidence that this virus is a complex of strains [33, p. 325] has been confirmed.

Up-to-Date potato stocks at Rietrivier Settlement are still free from virus X [33, p. 657] but are to be replaced by Buffelspoort 49, a better X-free strain.

S. J. du Plessis, in a section on plant control and quarantine (pp. 125–129), reports that during the 1953–4 season 530 vine nurseries in Cape Province, four in Natal, 34 in the Transvaal, and five in the Orange Free State were registered as being free from bacterial blight (*Erwinia vitivora*) [35, p. 75].

The 1954 seed potato crop offered was about 12 per cent. smaller than was estimated during the second land inspection for the AA certificate [34, p. 52], chiefly owing to *P. infestans*. It is of note that no potato land was condemned on account of virus diseases during the 1954 winter crop inspections; leaf roll, the only virus disease observed, was never more than 0·1 per cent.

Sugar-cane mosaic [virus: 33, p. 562] was found throughout the area along the northern coast of Natal from Tongaat to Pongola and south to Umzinto, but the position in the northern coastal and Zululand areas has improved markedly since the partial withdrawal of the susceptible Co 281. The varieties N:Co 310 and N:Co 339 are badly infected in the Umzinto district, chiefly owing to the use of infected

planting material. Chlorotic yellow leaf disease [? chlorotic streak: 32, p. 213] is fairly general, particularly on N:Co 310 cultivated under moist conditions. Smut [*Ustilago scitaminea*: 32, p. 214] is ubiquitous, particularly on Co 301, and appears to be increasing.

To ensure strict control of the plants and plant products imported into the Union plant control permits for importation will be issued in future only by the head of the Division of Plant Control and Quarantine. Plant Inspectors have been assigned almost exclusively for harbour and airport inspections. Some seed potato consignments arriving at Cape Town from Europe and Canada were infected with *P. infestans*, and there was a high percentage of *Actinomyces scabies*. *Spongospora subterranea*, and *Rhizoctonia* [*Corticium*] *solani*.

To improve the phytosanitary certification of seeds in general a distinction is made between seed field-inspected in the Union, and that not so inspected or imported for reconsignment, but offered for certification.

R. I. Nel, reporting on deciduous fruit research (pp. 156–159, 198–199), states that infection of apricot trees by *Pseudomonas syringae* [cf. 34, p. 795] takes place through open wounds only. The bacterium does not appear to oversummer in the leaf spots. Organic copper compounds gave some degree of control in experiments. Silver leaf (*Stereum purpureum*) in peaches may be controlled by covering wounds with red lead and white lead paint but Bordeaux mixture is unsuitable.

R. H. Marloth, reporting on citrus and subtropical fruit research (pp. 160–165) states that black spot [*Guignardia citricarpa*] is still increasing in commercial citrus orchards in the Lowveld. Good control on Valencia oranges was secured with three sprays at six-weekly intervals with 2–1–80 Bordeaux mixture and bound copper at 1½ lb. to 80 gals., but 2,4-D and flit 406 [captan] were of little use. Investigations on citrus wastage led to the conclusion that the main cause of decay in navel oranges within the first week of unloading abroad is from insect damage followed by an attack of green mould [*Penicillium digitatum*]; subsequent wastage was due to *Diplodia* stem-end decay [*D. natalensis*] in fruit which had not been immersed in 2.4-D prior to packing. The use of diphenyl-impregnated wraps reduced the incidence of green mould other than that following insect damage, which must be controlled, or a reduction effected in the number of such fruits packed inadvertently.

A. R. Saunders reports from the Natal Region (pp. 194–197) that *Ascochyta phaseolorum* attacked the leaves, stems, and pods of cowpeas [30, p. 309]; this appears to constitute a new record for the Union.

J. Reyneke, in charge of tobacco research (pp. 166–168, 197–198), states that unfavourable spring weather caused late planting, resulting in considerable damage from mildew [*Erysiphe cichoracearum*]. Its development is favoured by high atmospheric humidity around the plants. Iscothan and karathane [cf. 32, p. 169] gave good control. Since the discovery that immunity from the disease is carried by *N*[*icotiana*] *glutinosa* and that the factor is inherited, rapid progress should now be made in this field. Mosaic virus still causes considerable losses and has spread to practically all the tobacco-growing regions.

Wallace (G. B.). **Annual Report of the Plant Pathologist, Lyamungu, Moshi, for the year 1954.**—*Rep. Dep. Agric. Tanganyika, 1954* (Part II), pp. 70–76, 1955.

In this report [cf. *R.A.M.*, 34, p. 350] it is stated that a severe form of cigar-end rot (*Verticillium theobromae*) [32, p. 324] affecting the whole fingers is fairly common in the Kilimanjaro banana variety Nlelembo, mostly from July to October. The closely related variety Nshonowa is resistant. Maize rust [*Puccinia polysora*: 34, p. 577] was severe on the coastal plain and at Mahenge, Morogoro, and Kilosa. Sugar-cane ratoon stunting [loc. cit.] was observed near Moshi and at Chambezi on the coast. Experiments on the control of the virus in planting

material by heat treatment are being conducted at Muguga, Kenya. The most serious tomato diseases were a bacterial rot probably caused by *Bacterium carotovorum* var. *atrosepticum* [*Erwinia atroseptica*] on a half-acre field and grey leaf spot (*Stemphylium solani*), new to East Africa, in a large planting of canning tomatoes.

New records for Tanganyika during the year were *Helminthosporium bicolor* on banana and *Cladosporium macrocarpum* and *Erysiphe graminis* on wheat; new host records for the Territory include *Fusarium oxysporum* on asparagus, *F. solani* on banana, and a fungus of the *Colletotrichum capsici* group on groundnut.

In the Annual Report of the Plant Pathologist, Arusha (pp. 77–81), N. B. Joy states that the most serious diseases of dwarf bean [*Phaseolus vulgaris*] were halo blight (*Pseudomonas* [*medicaginis* f. sp.] *phaseolicola*) [31, p. 162], anthracnose (*C. lindemuthianum*) [loc. cit.], and common bean mosaic [virus: loc. cit.], in descending order of economic importance.

Summarizing the work of the Coffee Research Station, Lyamungu (pp. 37–42), F. R. Sanders states that *Hemileia vastatrix* was again fairly widespread on trees bearing a heavy crop and some severe defoliation occurred. Dr. B. d'Oliveira of Sacavém, Portugal, has isolated several strains of the fungus from material originating from the coffee areas of the eastern hemisphere, including eight strains from this Station, one of which has proved to be the most virulent discovered so far. Selections H66, KP 423, and KP 532 are immune from all the strains tested except this one.

Tidbury (G. E.). **Annual Report of the Department of Agriculture, Zanzibar Protectorate, 1954.**—31 pp., 1955.

In this report [cf. *R.A.M.*, 34, p. 137] it is stated (pp. 11–15) that under the new scheme for the experimental control of clove diseases plots have been laid out to determine whether plantations recently destroyed by 'sudden death' [*Valsa eugeniae*] can be successfully replanted with cloves, following root removal, cultivation, and liming. The beneficial effects of side protection, overhead shade, and particularly clean weeding continue to be very marked in certain blocks of clove saplings recently threatened by 'slow decline' [loc. cit.]. The value of pruning and the protection of exposed tissues in controlling die-back [*Cryptosporella eugeniae*] was again amply demonstrated, and the danger of branch-breaking during harvest appears now to be generally known. The cost of die-back control in government plantations during the year averaged Shs. 2·32 per tree for over 6,000 trees. Over 280,000 selected clove seedlings were distributed to the public during the year.

Early maize hybrids selected for resistance to rust (*Puccinia polysora*) [33, p. 411 and next abstract] were tested at Kizimbani, some proving hypersensitive to the disease, but as the rust generally attacks only after the cobs have formed it may not prove to be so serious as on the mainland.

Annual Report on the Department of Agriculture (Central), Federation of Nigeria, for the year 1952–53. Part II.—47 pp., 1 map, 1955.

In the plant pathology section (pp. 34–36) of this report [cf. *R.A.M.*, 34, p. 708] C. A. Thorold describes how the programme for the control of cacao black pod (*Phytophthora palmivora*) found successful on small plots [33, p. 219] was extended in 1952–3 to a group of farms at Aponmu, Ondo Province, where the average yield (which should exceed 11 pods per tree for the method to be economical) was 14 per tree. Twelve applications of 1 per cent. carbide-Bordeaux mixture [loc. cit.] were applied at intervals of three weeks from April to December on 21,661 trees. During the period up to February, 1953, there were 0·8 black pods per tree or 6·2 per cent. of the total pods, compared with 75 per cent. black pods on a neighbouring untreated area. The corresponding figures where black pods were removed every other day were 9·6 per tree or 65·6 per cent. Costing showed that

the former method was economic and the latter, suitable only for low-yielding trees, was not.

Heavy incidence of cotton bacterial blight [*Xanthomonas malvacearum*: 34. p. 645] showed up differences in resistance among selections of Samaru 26C, previously thought to be uniformly satisfactory, 4998–14 in particular sustaining severe leaf damage.

Covered smut (*Sphacelotheca sorghi*) was found on *Sorghum* in all the northern areas.

The first potato crop in the Bamenda highlands (above 6,000 ft.) was completely destroyed by a disease thought to be blight (*Phytophthora infestans*) [C.M.I. map No. 109]. The presence of the disease was confirmed in the second crop.

Ephelis pallida [see next abstract] was recorded for the first time in Nigeria on rice in a tidal swamp near Port Harcourt.

Sugar-cane red rot (*Colletotrichum falcatum*) [*Glomerella tucumanensis*: 34. p. 709] has now been detected in six northern Provinces. In the section dealing with research on maize rust (*Puccinia polysora*) [35. p. 12 and preceding abstract] (p. 47) it is stated that further tests have confirmed earlier observations that the source of high resistance is confined to Central America and the Caribbean area. F_1 hybrids between the United States varieties, White Tuxpan and American Bounty, selected under Nigerian conditions for four generations, and resistant selections of material received from the Rockefeller Institute, Mexico, (Rocamex Lines) are now undergoing primary yield tests. In the presence of rust these American varieties, though partially susceptible, have given twice the yield of the local lines.

Owing to the early onset of the rains in Nigeria and the Gold Coast in 1953 much of the maize in the forest county escaped severe attack; where, however, sowing was done as usual the rust developed, as in previous years, at tasselling time.

Under optimum conditions the uredospores of *P. polysora* cease to be viable after 40 days. Temperatures under 10° C. are rapidly lethal to them. Infection may occur on the first leaf of a seedling, but in the field it does not usually take place until the leaf is comparatively mature. Sporulation is heaviest on the leaf sheath, where the pustules, though scattered, may measure 0·5 to 1 cm. long.

Deighton (F. C.). **Plant pathology section.**—*Rep. Dep. Agric. S. Leone, 1952*, pp. 29–30, 1954; *1953*, pp. 33–34, 1955.

In the 1952 report [cf. *R.A.M.*, 33. p. 659] it is stated that once again attacks of maize rust (*Puccinia polysora*) [loc. cit.] on local varieties were light.

Ephelis pallida [loc. cit. and preceding abstract] attacked the rice varieties Konko, Hadji Harun, HBJI, 79/52, D. 52 37, DC. 39/15, No. 79, Sidiankay, Peru 22, D. 99, Kav. 12, Indo-China 70, and Toma 280, and was also found on *Paratheria prostrata*, a new host record. Fungi newly recorded on rice in Sierra Leone included *Neottiospora* sp., *Myrothecium striatisporum*, *Phyllosticta miyurae*, *Pyrenochaeta oryzae*, *Dactylaria* sp., *Periconia minutissima*, *P. digitata*, and *Sporidesmium bakeri* var. *maydicum*.

The *Cercospora* on rose [33. p. 660] was definitely identified as *C. puderii*. Further new records of minor importance included *C. elaeidis* on oil-palm, *Cephalosporium eichorniae* on coffee, *Cerotelium corchori* on jute, and *Myrothecium roridum* on cacao seedlings.

In the 1953 report it is stated that during the 1953–4 season the occurrence of *E. pallida* on rice was very slight, only about one infected panicle in 2,000 being recorded on D. 99. The finding of the smut *Neovossia horrida* on a wild rice (*Oryza barthii*) and on a single infected head of the variety Raminad, introduced from the Philippines in 1952, constituted what is believed to be the first record of this fungus in Africa [C.M.I. map No. 75].

Minor new records for Sierra Leone included *Septoria lactucae* on lettuce, *Torula*

herbarum on onion, and *Fomes senex* occurring commonly on *Albizzia adianthifolia* and *Deniella thurifera*.

Fourth Annual Progress Report of the Colombia Agricultural Research Program of the Ministry of Agriculture and the Rockefeller Foundation for May 1, 1953 to May 1, 1954. –156 pp., 33 figs., [? 1955. Mimeographed].

In the plant pathology section (pp. 127–145) of this report it is stated that a sudden wilting of beans [*Phaseolus vulgaris*] in Palmira was due to a *Pythium* sp. In Medellín a new bean disease named 'floury blotch' and caused by *Acrostalagmus albus* [*Verticillium album*] is not yet of economic importance.

During 1953 maize stalk and ear rots were under investigation, *Fusarium moniliforme* [*Gibberella fujikuroi*: C.M.I. map No. 102] being most frequently isolated.

Root rot of *Crotalaria* was shown to be due to a complex of *Rhizoctonia* [*Corticium*] *solani*, *Macrophomina phaseoli*, and *Fusarium* spp.

In field experiments in four successive seasons with sulphur for the control of bean rust (*Uromyces phaseoli*) [*U. appendiculatus*: No. 290], the most important disease locally in 1951, the yield of the resistant variety Uribe Redondo was increased while that of the highly resistant Algarrobo was consistently decreased. In 1953 *Isariopsis griseola* [*R.A.M.*, 33, p. 282], the agent of angular leaf spot, and *Colletotrichum lindemuthianum* [C.M.I. map No. 177], causing anthracnose, were as destructive as rust; both were controlled in trials by applications of fermate with a spreader-sticker. Algarrobo showed good resistance to *C. lindemuthianum* while Chiquito Colorado was resistant to all three pathogens as well as to *Xanthomonas phaseoli* [cf. *R.A.M.*, 34, p. 339] and *Pseudomonas* [*medicaginis* f. sp.] *phaseolicola* [33, p. 282]. Despite this resistance the yield of the latter variety was increased by 31 per cent. by spraying with copper A, fytolan, or arasan.

In seed treatment trials for the control of [unspecified] damping-off in beans the best results were obtained with arasan and rootone (containing arasan together with a growth hormone).

In the Bean Improvement Programme (pp. 85–92) Liborino was the most resistant to root rot (*M. phaseoli*), Cauca 27A to the bean diseases mentioned and mosaic virus, while Mexico 53 was resistant to the first three and root rot. Attempts to control *Helminthosporium turcicum* [loc. cit.] and *Puccinia sorghi* [33, p. 281] on maize were not very successful, the plants being severely burned by copper-containing sprays. On p. 34 it is stated that the new white hybrid Rocol H–251, ready for release, is fairly resistant to both these diseases.

The Wheat Improvement Programme survey (p. 72) has shown that *Puccinia glumarum* [34, p. 288] was most serious at Tibaytata, La Isla, and Pasto, while *P. graminis* was most prevalent at Bonza. McMurachy, Timopheevi, and C.I. 7805 were the varieties most resistant to the former rust at all locations while C.I. 7805, Minn. II 50–17, and Minn. II 50–18 were highly resistant to both rusts and *P. triticina* [33, p. 281] at all centres.

In the Barley Improvement Programme (pp. 77–78) *Puccinia anomala* [*P. hordei*] was the most serious pathogen, with *P. glumarum* second. Lansdale, Moroccan, and Australian 22 are resistant to the former.

All fungicides tested (at 1·8 to 2·7 kg. per 700 gals. every 7 to 10 days) on the Tocanablanca variety under the Potato Improvement Programme (pp. 108–109) increased yields considerably, crag giving the maximum of 167·2 cargas per ha., followed by 164·8 for copper oxychloride (20 per cent. copper), which is considered the best general-purpose fungicide for the control of *Phytophthora infestans* [34, p. 807]. The unsprayed gave 84·8 cargas per ha. [1 carga=275·6 lb.]

Smith (W. K.). **The pectic enzymes of bacterial pathogens of plants.**—*J. gen. Microbiol.*, 13, 1, p. xi, 1955.

The ability of pathogenic and other bacteria to produce pectic enzymes was

examined at the Akers Research Laboratories, Welwyn [Herts.], as a basis for the development of specific enzyme inhibitors for the treatment of plant diseases. The following genera produced γ-pectinglycosidase: *Erwinia* (13 out of 14 strains), *Pseudomonas* (5 out of 15), *Xanthomonas* (3 out of 16), *Bacillus* (5 out of 6), the coliform group (1 out of 14), and *Flavobacterium* (1 out of 1). Ability to produce pectin methyl esterase was confined to the soft rot pathogens *E. carotovora*, *E. aroideae*, *E. atroseptica*, and *E. phytophthora*, and *X. campestris*.

Klein (R. M.) & Tenenbaum (Ida L.). **A quantitative bioassay for crown-gall tumor formation.**—*Amer. J. Bot.*, 42, 8, pp. 709–712, 2 graphs, 1955.

In the course of work at the New York Botanical Garden on a quantitative bioassay for crown gall tumour formation, using carrot tap-roots and a highly virulent isolate of strain 6 of *Agrobacterium tumefaciens* [*R.A.M.*, 34, p. 774], the following method of tissue standardization was adopted. Radial cylinders were removed aseptically with a cork borer from a sterilized, 2-cm. segment taken from the upper two-thirds of the root and disks were sliced from the different tissues, placed on moistened filter paper in Petri dishes, inoculated with 0·02 ml. of the bacterial culture, and incubated for 15 days at 26° C. Yellow to white spherical masses were visible six or seven days later.

Since the young phloem tissues adjacent to the cambium displayed the most pronounced tumour reaction and are reported to be relatively insensitive to the growth-promoting influence of indoleacetic acid (*Amer. J. Bot.*, 41, pp. 321–326, 1954), they were regarded as the most satisfactory for bioassay purposes. Accordingly, disks of young phloem about 2·5 mm. thick were inoculated on the cambial-adjacent surface. The roots from which disks showing the desired reaction capacity had been taken were stored in plastic bags at 8°, three carrots each of strong and weak tumour reaction, i.e., producing average tumour weights of 108 ± 10 mg. and 18 ± 3 mg. per disk, respectively, being retested three weeks after the initial assay. For bioassays with carrots of known reaction capacities, a replication of eight to ten disks gave results significant at about the 5 per cent. level.

Individual storage roots of garden beet and parsnip exhibited variations in tumour-forming capacity similar to those found in carrot. From 60 to 80 per cent. of the beets tested developed tumours of a relatively narrow range of weight per disk. Most of the tumour tissues were derived from the cambium thus rendering quantitative assays rather difficult. Parsnip roots, however, were treated exactly like the carrots, with similar results.

Höhn (K.). **Pflanzliche Krebsdisposition, Wuchsstoffspiegel und Blühwilligkeit.** [Tendency to crown gall in plants, auxin level, and floral precocity.]—*Naturwissenschaften*, 42, 12, pp. 373–374, 1955.

Experiments were performed at the Botanical Institute of the University of Mainz, Germany, to determine the relation of auxin level and floral precocity to a predisposition to crown gall (*Agrobacterium tumefaciens*) in plants, using Stapp's IIb strain from *Chrysanthemum frutescens* [*R.A.M.*, 34, p. 216].

In young tomato and *Bryophyllum daigremontianum* plants susceptibility increased from the lower nodes to the upper. Attempts to enhance the susceptibility of older tissue by the application of β-indole acetic acid or by infiltration with a mixture of this with sap from the offset bulbs of *B. daigremontianum* were unsuccessful. It was demonstrated by artificial reduction of the auxin level through irradiation with ultra-violet light that the strong tendency of young tissue to contract infection is related primarily to its natural growth substance content.

In a further series of tests the suppression of the natural auxins by means of 2,3,5-tri-iodine benzoic acid resulted in a reduction of susceptibility in sunflower, *Kalanchoe blossfeldiana*, and tomato, as also did the prevention of growth substance

synthesis by shading. Tumour growth was stimulated, however, by small doses of both irradiation and tri-iodine benzoic acid. In tomato and sunflower susceptibility to *A. tumefaciens* decreases with the transition from the vegetative to the reproductive phase. This process is attributed in the first instance to a lowering of the auxin level and secondly to the cessation of meristematic activity with the onset of flowering and fruiting.

LACEY (MARGARET S.). **The cytology and relationships of Corynebacterium fascians.** —*Trans. Brit. mycol. Soc.*, 38, 1, pp. 49–58, 1 pl., 4 figs., 1955.

Corynebacterium fascians [*R.A.M.*, 31, p. 56] grown on a synthetic medium of low nitrogen content at the Imperial College of Science and Technology, London, showed marked cytological differences from cultures on peptone media, the cells varying from coccoid forms to long, unsegmented filaments similar to those of *Nocardia*. Reproduction frequently took place by the abscission of one to six or more cocci in a chain from one end of a long rod. The cocci and the tip of the parent cell stained deeply with methyl violet but the rest of the parent cell either stained faintly or not at all except for scattered granules. Acid-fast bodies, sometimes completely filling the cells, developed in 29 out of 30 pathogenic strains of *C. fascians* isolated from 14 different hosts and grown on a synthetic medium. Of four pink, non-pathogenic cultures, two were non-acid-fast and two feebly so. Cultures grown on a variety of peptone media were invariably completely non-acid-fast.

Annual Report West African Cacao Research Institute. April, 1953 to March, 1954.— 52 pp., 1 pl., 1954. [Received 1955.]

In the virus research section of this report (pp. 8–14) [cf. *R.A.M.*, 34, p. 352] it is stated that the survey of natural infection by cacao swollen shoot viruses [see next abstract] in *Cola chlamydantha* has now been completed and its importance as an additional host in the wetter vegetation zones of the Western Province of the Gold Coast has been established. Mealybugs (*Pseudococcus njalensis* and other *P.* spp.) still remain the only established vectors of the disease.

In 1947 two field experiments were begun to examine the possible immunization of cacao trees from virulent strains of the New Juaben complex by inoculating them with mild strains [33, p. 218]. In one test all apparently healthy trees remaining in a plot of the 'rate of destruction experiment' [loc. cit.] were infected with a mild strain by grafting; both virulent and mild strains were subsequently isolated. The danger, however, of trees so protected harbouring the virulent strain, and the uncertain effect of the mild strain in the long run, render this method of control inadvisable.

In tests with the New Juaben strain, young adults of *P. njalensis* were starved for 18 hours, allowed to feed on infected plants for 24 hours, and transferred to dissected beans, on which they were left for periods of 2, 4, 8, 16, 32, or 64 hours. Two hours' feeding gave 64 per cent. infection and for the longer periods this only varied from 80 to 87.

In tests of all the available West African species related to *Theobroma cacao* as possible alternative hosts, evidence has been obtained of differential susceptibility of some of the hosts to different strains of the virus.

In the section on mycology (pp. 27–28) further investigations on the means of survival of *Phytophthora palmivora* during the dry season are reported [34, p. 353]. The fungus was isolated between February and July from pods buried in six different types of soil [loc. cit.].

One thousand trunk cushions bearing healthy cherelles and pods were labelled on trees at Bunso Plantation which were regularly sprayed with carbide-Bordeaux mixture [see above, p. 164] to lessen the likelihood of pod infection by spores.

Fortnightly observations were made, including examination of the cut peduncles of ripe and diseased pods for necrosis. On 19 per cent. of the cushions diseased peduncles were found, indicating spread of infection from cushion to pod or vice versa. Resistance to black pod may relate to spore germination and penetration. Diseased pods usually have only one initial infection point, and spraying unwounded pods with spore suspensions will rarely produce more. Tannic and chlorogenic acids extracted from husks failed to inhibit *P. palmivora* mycelium on agar. The investigation of stomatal entry continues. Yields and pod disease incidence were recorded at Bunso prior to the start of a spraying experiment. During the crop season 70 per cent. of all pods were damaged by diseases and pests, and 46 per cent. had to be discarded. *P. palmivora* infected 43 per cent. and made 27 per cent. of the crop worthless.

Tests designed to examine the reduction of damage due to capsids and *Calonectria rigidiuscula* [cf. 34, p. 86] by a combined spray of carbide-Bordeaux mixture and DDT emulsion gave promising results.

Report of the Cocoa Conference held at Grosvenor House, London, 15th to 17th September, 1953.—xiv + 148 pp., 5 pl. (1 col.), 5 col. diags., 6 col. graphs, 12 col. maps, London, The Cocoa, Chocolate and Confectionery Alliance Ltd. [1953.]

In this report [cf. *R.A.M.*, 31, p. 424] an account of the Anglo-Colombian Cocoa-collecting expedition organized to obtain new breeding material of *Theobroma* and related species was presented by F. W. Cope (pp. 57–63), being supplemented later by an illustrated talk by Prof. R. E. D. Baker.

J. D. Broatch (pp. 76–79) reviewed the progress of the cacao swollen shoot virus control campaign in the Gold Coast [34, p. 518 and preceding abstract] during the preceding two years and A. E. Moss (pp. 88–90) discussed the future prospects of cacao production there. He concluded, on the basis of surveys of 2,750,000 acres of cacao trees, which were classified by ages, that assuming effective control of the swollen shoot disease, the output should rise during the next 15 years but is unlikely to reach 300,000 tons per annum.

R. B. Allnutt (pp. 91–97) described the rehabilitation of the cocoa industry in the western region of Nigeria, covering the period February 1952 to February 1953. The sealing-off policy [31, p. 426] had proved disappointing, since the numbers of foci of infection in the protected area had increased from eight in 1951 to 42 in 1953. The distribution of these did not suggest spread from the area of mass infection but rather that the virus is endemic in the protected area and possibly exists in latent forms. In addition to attempts at control steps were being taken to restore the economy of the area of mass-infection by re-planting cacao and substituting other crops such as citrus and oil-palms.

According to C. A. Thorold (pp. 108–115), studies on black pod (*Phytophthora palmivora*) [34, p. 708 and above, p. 164] in Nigeria had shown that large scale control could be economic. Suggested treatments for cacao trees in various rainfall areas and with differing degrees of infection were illustrated by tables. It was estimated by R. E. D. Baker (pp. 115–116) that in an abnormally wet year, generally about once in five years, losses of cacao in Trinidad due to black pod [34, p. 353] might be as serious as those due to witches' broom (*Marasmius perniciosus*) [34, p. 709], and were often wrongly attributed to the latter. R. G. Orellana (pp. 117–120) stated that 47 per cent. loss of cacao from *P. palmivora* was experienced at La Lola experimental farm, the Inter-American Cacao Centre, Turrialba, Costa Rica, in 1953 [33, pp. 340, 713]. In fungicidal control experiments the best results were obtained with Bordeaux mixture and dithane Z-78, applied every 30 days. Methods of combating brown pod rot of cacao (*P. palmivora*) in Brazil [34, p. 354] were outlined by S. Miranda and H. M. da Cruz (pp. 120–122). The disease was calculated to be responsible for a loss of 18 to 25 per cent. of the

total output of Brazilian cacao. Breeding for resistance was being carried out and SIC 28 (Selection of the Institute of Cocoa No. 28) was highly resistant. Prophylactic measures consisted of regular pod removal followed by pruning. Sprayers and fungicides were sold at cost price.

Situation of West African Cacao.—*Cacao* (*Int.-Amer. Cacao Cent.*), 3, 7, pp. 1–2, 1955.

It is stated in this article that there appears to be no swollen shoot virus on cacao [cf. preceding abstracts] in the French Cameroons.

Smith (H. C.). **Report on Cocoa diseases in Samoa.**—11 pp., Department of Scientific and Industrial Research, New Zealand, 1955. [Mimeographed.]

A survey of cacao in the three main islands of Western Samoa, viz., Savaii, Upolu, and Tutuila (American Samoa), made during the period February to April, 1955, showed that the chief diseases present are black pod and canker (*Phytophthora palmivora*) [*R.A.M.*, 34, p. 439], pink disease (*Pellicularia* [*Corticium*] *salmonicolor*) [loc. cit.], root rot (*Fomes noxius*), and three disorders, marginal scorch, yellowing, and narrow leaf, apparently due to potassium, iron, and zinc deficiency, respectively.

Black pod incidence varied more between plantations than between districts. Canker, the principal cause of death, was present in almost every plantation visited, but was most severe where the cacao had been overgrown by shade trees and other crops. It was prevalent in wet and also in high situations, but there were exceptions, especially where clean cultivation and careful pruning had been practised. It was seldom found in plantations under eight years old, but even in old, well-managed plantations about 50 per cent. of the trees had been lost or replanted on account of canker.

In an experiment in which Bordeaux concentrate was applied by a portable, petrol-driven mist blower every three weeks, three times as many pods were picked at the fourth picking from the sprayed as from the unsprayed rows. In further experiments, where the crop was light or disease incidence low spraying with Bordeaux (3–4–50) and phygon (½ lb. to 50 gals.) was uneconomic. In tests with different pumps the use of a petrol-driven mist blower for the application of Bordeaux concentrate resulted in 14 per cent. black pods as against 23 per cent. for a knapsack hand-sprayer and Bordeaux (3–4–50): unsprayed, densely planted trees bore 73 per cent. black pods.

The cost (material and labour) of Bordeaux spraying with a machine blower is estimated at £2 per acre per annum. Increased production would be at least 50 per cent. on a yield of 5 cwt. per acre, giving a gross return (at £300 per ton) of £37 per acre.

An inoculation technique for testing for resistance which gave consistent results is described. Lafi 7 cacao [loc. cit.], though apparently field-immune, was susceptible to *P. palmivora* when subjected to these tests. Other cacao trees exhibiting a higher degree of resistance were found.

For black pod control the trees should be well pruned, the branches kept open, and chupons and branches with die-back and black pods removed and left on the ground, not collected into heaps. Close planting should be avoided and shade trees should be as few as possible. Trees should be sprayed if the pods average more than 10 per tree and over 20 per cent. blacken. Resistant clones should be planted when available. All papaw trees bearing fruit with white rot (*P. palmivora*) [cf. 20, p. 7] should be cut down.

Pink disease was found in every locality where cacao is grown. Shade should be kept thin round young trees, and infected branches cut out.

The stumps and roots of trees killed by *F. noxius* should be dug up and burnt, and diseased roots of recently affected trees removed and destroyed.

Van Suchtelen (N. J.). **Ziekten van de Cacao in Suriname.** [Cacao diseases in Surinam.]—*Surinaam. Landb.*, 3, pp. 18–29, 11 figs., 1955.

The rehabilitation of the cacao industry in Surinam has been accompanied by the phytopathological problems incidental to large-scale cultivation, and in this connexion essential information is presented on the diseases encountered in the country and the most effective measures for their control. They include witches' broom (*Marasmius perniciosus*) [*R.A.M.* 14, p. 430]; brown rot (*Phytophthora spp.* [including *P. palmivora*: 34, p. 711]); bark disease (*Calostilbe striispora*) [cf. 33, p. 414], a new record on cacao for Surinam, where it has so far been observed only in a sporadic form; it also causes an intensely rapid die-back of old coffee bushes; pink disease (*Corticium salmonicolor*); a hitherto unreported leaf spot caused by a species of *Cercospora* producing angular, necrotic lesions up to a few mm. in diameter; red root rot (*Ganoderma pseudoferreum*); another form of root rot due to *Rosellinia pepo* [cf. 32, p. 71], only lately identified with certainty in Surinam, where citrus and coffee are also susceptible; [unspecified] spider's web or 'silver thread' fungi and *Pellicularia* [*Corticium*] *koleroga*, the agent of a similar necrosis; 'basket disease', so called because the cane of the baskets used for raising seedlings is liable to infection by a species of (?) *Marasmius* which tends to make contact with the bark, where a mycelial mat is formed and the portion above it killed; and various physiological or nutritional disorders.

Control is based largely on sanitary practices in the plantation; cankers of *Phytophthora palmivora* should be excised and the wounds treated with Bordeaux paste or petroleum jelly, e.g., Socony 2295 A [33, p. 256] plus 5 per cent. fruit tree carbolineum.

Field experiments, 1952.—*J. Dep. Agric. Eire*, 50, pp. 163–179, 1953–54.

On pp. 175–177 of this report [cf. *R.A.M.*, 34, p. 23] the results are given of further trials carried out in the Republic of Ireland in 1952, in which spring wheat seed was treated at 34 centres and oats seed at 49 centres with a combination of gammexane [*gamma*-BHC] and an organo-mercurial [loc. cit.] against wireworms and seed-borne fungal diseases, and, for comparison, with a standard organo-mercurial. Slight attacks of bunt [*Tilletia caries*: loc. cit.] and *Fusarium* spp. on wheat were controlled by both dressings. On oats only *Helminthosporium* [*Pyrenophora*] *avenae* [loc. cit.] was present, and both dressings gave satisfactory control. The average yield of wheat grain at nine centres from seed treated with the combined fungicide was 27·45 cwt. per acre, the figures for the standard treatment being 25·57, and the untreated 23·33. The corresponding oat yields (averages of 14 centres) were 22·39, 20·59, and 18·35.

Nilsson (L.). **Svartrostens utbredning i Skåne år 1954.** [The distribution of black rust in Scania in the year 1954.]—*Växtskyddsnotiser, Stockh., 1955*, 1, pp. 1–4, 1 map, 1955.

Particulars are given of a local epiphytotic of wheat black rust [*Puccinia graminis*] in the south of Sweden [*R.A.M.*, 33, p. 22] in the summer of 1954. An attempt was made to trace the development of outbreaks to the presence of barberries in 11 centres, but no direct connexion could be established. However, the persistence of these sources of infection constitutes a potential threat of heavy losses, and public co-operation is necessary to support the local authorities in the eradication campaign [33, p. 77].

Aristeo Acosta (C.) & Livingston (J. E.). **Effects of calcium sulfamate and sodium sulfanilate on small grains and on stem rust development.**—*Phytopathology*, 45, 9, pp. 503–506, 1955.

The trials herein reported from the Nebraska Agricultural Experiment Station were undertaken to study the types of injury to wheat, barley, and oats resulting

from treatment with calcium sulphamate [*R.A.M.*, 33, p. 341] and sodium sulphanilate for the control of stem rust (*Puccinia graminis*) and the factors promoting such adverse effects.

Two sprays of an aqueous solution of calcium sulphamate (either 9 or 12 lb. per acre), the first when about 50 per cent. of the plants had been pollinated and the second a week later, markedly reduced the germination of Centenario, Mida, Rushmore, and Nugget wheat and of Nemaha and Kanota oats but only slightly diminished that of Feebar and Custer barley. Wheat yields were increased in three and those of oats in two out of four experiments. The incidence of *P. graminis* was substantially reduced in all three crops. Sodium sulphanilate caused no apparent damage and gave effective control of the rust.

Injury to wheat from calcium sulphamate was found to depend on the stage of growth at which the treatments were given. Yields were reduced only by applications at tillering and germination impaired by those following pollination. Treatment with sodium sulphanilate a week after tillering and six days after flowering resulted in a significant increase in yield.

Forsyth (F. R.). **The nature of the inhibiting substance emitted by germinating urediospores of Puccinia graminis var. tritici.**—*Canad. J. Bot.*, 33, 5, pp. 363–373, 1 pl., 3 graphs, 1955.

At the Plant Pathology Laboratory, Winnipeg, the self-inhibition of germinating uredospores of *Puccinia graminis tritici* from wheat [*R.A.M.*, 34, p. 711] was shown to be due to the production of trimethylethylene.

Vasudeva (R.S.), Prasada (R.), Lele (V. C.), Joshi (L. M.), & Kak (D.). **Prevalence of physiologic races of Wheat and Barley rusts in India.**—*Indian Phytopath.*, 8, 1, pp. 22–51, 1 graph, 1955.

The authors tabulate the occurrence and distribution by States from 1932 to 1952 of physiologic races of *Puccinia graminis*, *P. triticina*, and *P. glumarum* on wheat, barley, and some grasses in India [*R.A.M.*, 34, pp. 578, 772, and following abstracts]. Races 15, 21, 40, and 42; 10, 20, and 63; and 19 and 'A' of these three rusts, respectively, were the first to be identified in India and have been prevalent almost every year.

Vasudeva (R. S.), Lele (V. C.), & Misra (D. P.). **A new physiologic race of Puccinia triticina Eriks. in India.**—*Indian Phytopath.*, 8, 1, p. 73, 1955.

An analysis of wheat rust samples from the 1953–4 crop revealed a new physiologic race of *Puccinia triticina* [*R.A.M.*, 34, p. 578 and preceding abstract] from Bihar similar to race 77 but differing from all other Indian races in attacking the differential varieties Mediterranean and Democrat.

Misra (D. P.) & Lele (V. C.). **Mutation in Puccinia graminis tritici (Pers.) Eriks. & Henn. physiologic race 15-C.**—*Indian Phytopath.*, 8, 1, pp. 79–81, 1955.

In the course of race maintenance work at the Rust Research Laboratory, Simla, a mutant was observed in the fifteenth generation of a pure culture of race 15C of *Puccinia graminis tritici* [*R.A.M.*, 29, p. 553]. It did not differ appreciably from the type race in pathogenicity to wheat and barley but was distinct in morphological characters, notably the smaller size of the uredospores and their colour, which was dull orange rather than dark brown.

Tingey (D. C.). **How long have we had dwarf bunt?**—*Plant Dis. Reptr*, 39, 4, pp. 325–328, 1955. [Multilithed.]

The author discusses, with frequent reference to the literature (18 titles), the earliest records of dwarf bunt (*Tilletia brevifaciens*) [*T. controversa*] on wheat in

the United States [*R.A.M.*, 34, p. 29]. There is evidence that it was first noticed in Michigan in 1892, Utah in 1903, New York in 1923, Oregon in 1926, Montana in 1931, and Colorado in 1941.

Stauber. **Zwergbrand an Weizen und Winterroggen im Landkreis Sulzbach-Rosenberg.** [Dwarf bunt on Wheat and winter Rye in the Sulzbach-Rosenberg district.]—*Pflanzenschutz*, 7, 11, p. 164, 1955.

In two places in the Sulzbach-Rosenberg district of Bavaria where very intensive wheat cultivation is practised, dwarf bunt [*Tilletia controversa*: *R.A.M.*, 34, pp. 356, 358] has been observed in varying amounts, causing losses up to 30 per cent. It occurs mostly where wheat is planted more than once in a six- or seven-year rotation. Since the spores remain viable in the soil for five to six years this practice involves a risk of continuous dissemination of infection. In a few instances winter rye plants following potatoes in a field adjoining a severely diseased wheat crop were also attacked by *T. controversa* [cf. 32, p. 472].

Lušin (Vera). **Problem domaće proizvodnje tileticida.** [The problem of domestic production of tilleticide.]—*Zasht. Bilja* (*Plant Prot., Beograd*), *1955*, 28, pp. 21–26, 1955. [English summary.]

In field trials in Yugoslavia of home-produced fungicides for the control of *Tilletia* spp. on wheat [*R.A.M.*, 34, p. 706] organic mercury preparations containing 1·89 to 3·78 per cent. mercury reduced the average infection to from 0·095 to 2·52 per cent., as against 0·158 per cent. for standard ceretan and 22·786 for the untreated in 1952. The corresponding figures in 1953, when the percentage of mercury ranged from 1·89 to 5·5, were 0·04 to 0·54, 0·2, and 25·69 per cent.; and in 1954 (1·5 to 4 per cent. mercury) 0·005 to 0·19, 0·09, and 27·33 per cent. Radosan, a product of the Radonja factory at Sisak, Croatia, is recommended for commercial use; it gives adequate control without impairing germination and is cheap to manufacture because of its low mercury content.

Di Caro (S.) & Quagliotti (F.). **Ricerche sul valore anticarie di diversi prodotti.** [Researches on the anti-bunt value of various products.]—*Ann. Sper. agr.*, N.S., 8, 4, pp. 1337–1354, 5 figs., 1954. [English summary.]

In a test carried out at Corticella, Italy, in an experimental plot belonging to the University of Bologna, Mentana wheat seed, inoculated with chlamydospores of bunt (*Tilletia* spp.) [*R.A.M.*, 34, pp. 361, 439] at the rate of 15 gm. per kg., was treated with two thiram products, AC_1, containing 50 per cent. active principle, and AC_2, 25 per cent., and FB_1 (hexachlorobenzene), oxychloride of copper and calcium, and agrosan GN [cf. 35, p. 94]. In the plot sown 30th October, 1952, and harvested 25th June, 1953, the treatments gave, respectively, 47·65, 64·57, 3·02, 42·45, and 7·82 per cent. infected ears, as compared with 87·55 per cent. for the infected, untreated control. In the plots sown 1st November and harvested 1st July the corresponding figures were 25·72, 34·8, 2·3, 34·35, 3·9, and 44·95 per cent.

In laboratory tests, using Gassner's method [22, p. 490], FB_1 and agrosan GN both inhibited spore germination completely, results closely parallel to those in the field, but in these latter tests AC_1 was only slightly less effective.

Flag smut of Wheat.—*Agric. Gaz. N.S.W.*, 66, 5, pp. 272–274, 2 figs., 1955.

Flag smut of wheat (*Urocystis tritici*) [*R.A.M.*, 33, p. 594] has become rare in New South Wales owing to the use of resistant varieties, originally Nabawa, subsequently Bencubbin, Ford, Dundee, Geeralying, and Ghurka, and more recently Charter, Celebration, Kendee, and Yalta [loc. cit.]. Crop rotation, with wheat only once in three years, is recommended to avoid smut, five years being sometimes necessary.

Dusting the seed with copper carbonate or organic mercury compounds (2 oz. per bush.) is recommended to prevent initial infection of new land. Moisture should be conserved since dry sowing favours the disease. Shallow sowing seems to help young plants to escape infection. Flag smut spores can pass uninjured through animals, therefore diseased straw should not be fed.

Nisikado (Y.), Inouye (T.), & Okamoto (Y.). **Conditions of the spores of the scabbed Wheat ear suspended in rain drops.**—*Ber. Ōhara Inst.*, 10, 3, pp. 125–134, 2 graphs, 1955.

In further studies on wheat scab (*Gibberella zeae*) at the Ōhara Institute, Okayama University, Kuraschiki, Japan [*R.A.M.*, 34, p. 222 and next abstract], the influence on spore liberation of the duration of water atomization on infected Norin 4 spikelets was investigated, the number of conidia so liberated decreasing as spraying (to simulate rain) continued. The number liberated after dipping infected spikelets in water was also studied. During the first 30 seconds of immersion $11{\cdot}3 \times 10^6$ conidia per spikelet were liberated in 100 ml. water, the corresponding figures for one, two, and five minutes being 13×10^6, $14{\cdot}5 \times 10^4$, and $15{\cdot}7 \times 10^6$, respectively. It was found that at least 16×10^6 mature conidia were produced on each of the spikelets used in the tests.

In experiments in which spore suspensions of known density were dripped on to healthy ears and allowed to run down them, about 20 per cent. of a 2 ml. suspension (ranging from approximately 3 to 5×10^4 per ml. in density) remained on the surface of the ear.

From the foregoing data it is concluded that the numerous conidia adhering to the ear may contribute largely to secondary dissemination and infection, which tends to develop on the spikelets below those showing scab symptoms and may easily be overlooked until the milky ripening stage.

Higashi (S.) & Kato (T.). **Studies on the resistance of Wheat and Barley varieties to ear-scab (Gibberella saubinetii (Mont.) Sacc.) I. Studies on the loci of the incipient attack by scab on Wheat-ears. II. Studies on the varietal difference of incipient attack of ear-scab.**—*Bull. Div. Plant Breed. Cult. Tokai-Kinki agric. Exp. Sta.*, 1, pp. 87–89, 90–95, 5 figs., 1 diag., 2 graphs, 1954. [Japanese, with English summary.]

The earliest natural infections of ear scab (*Gibberella saubinetii*) [*G. zeae*: see preceding abstract] on 11 wheat varieties grown at the Tokai-Kinki Agricultural Experiment Station, Ogoso, Japan, in 1950 appeared most frequently on the inside of the lemma, probably due to the favourable microclimate and high concentration of the products of photosynthesis. Wheat and barley varieties with a darker green central part of the glume were more susceptible than those with paler ones.

Ledingham (R. J.) & Chinn (S. H. F.). **A flotation method for obtaining spores of Helminthosporium sativum from soil.**—*Canad. J. Bot.*, 33, 4, pp. 298–303, 1 fig., 1955.

A flotation method for recovering spores of the wheat root rot pathogen, *Helminthosporium sativum* [*R.A.M.*, 33, p. 474; 35, p. 8], from soil samples was devised at the Plant Pathology Laboratory, Saskatoon, Saskatchewan. The water content of sieved soil was made up to 10 per cent. by weight, and a 10-gm. sample mixed with 5 ml. mineral oil, then shaken vigorously with 50 ml. water in a test-tube, for about five minutes. Most of the spores were extracted in the emulsion which collected at the surface. Samples of the emulsion were pipetted off, the spores counted on a microscope slide, and the number per gm. of soil calculated. The flotation count averaged 74 per cent. of that calculated by the dilution plate

methods. Out of 20 fields near Saskatoon, nine had between 25 and 50 *H. sativum* spores per gm. of soil, determined by the flotation count. None of the soils examined, including some garden ones, was entirely free from the fungus.

This method is applicable to the determination of spore numbers in the larger-spored species of fungi and may also be used in germination and longevity studies on smaller-spored species such as *Fusarium*. In the computation of total spore numbers an allowance should be made for the 10 to 20 per cent. left in the soil and a further 15 to 20 per cent. overlooked in examining the emulsion.

Sorger-Domenigg (H.), Cuendet (L. S.), Christensen (C. M.), & Geddes (W. F.). **Grain storage studies. XVII. Effect of mold growth during temporary exposure of Wheat to high moisture contents upon the development of germ damage and other indices of deterioration during subsequent storage.**—*Cereal Chem.*, 32, 4, pp. 270–285, 4 graphs, 1955.

In continuation of the current series of studies at the Minnesota Agricultural Experiment Station [*R.A.M.*, 34, p. 587], surface-disinfected samples of hard red spring wheat from Montana were inoculated with a mixed spore suspension of *Aspergillus glaucus*, *A. flavus*, *A. ochraceus*, *A. candidus*, *A. versicolor*, and *Alternaria* and *Penicillium* spp., held at 15, 18, or 21 per cent. moisture for 5, 10, and 15 days, and then stored at room temperature and approximately 14 per cent. moisture (the 21 per cent. samples also at 13 per cent.) for periods up to a year.

High levels of mould infection markedly increased the losses in viability, development of germ damage, and rises in fat acidity occurring during temporary storage at high moisture contents. In subsequent storage at 13 and 14 per cent. humidity the mould counts in most of the samples fell, but germ damage and fat acidity continued to develop. The inoculated samples temporarily exposed to 21 per cent. moisture gave large yields of poor-coloured flour with a high ash content. Other concomitants of heavy mould contamination were low baking strength and deterioration in baking quality during storage.

Fellows (H.) & Sill (W. H.). **Predicting Wheat streak mosaic epiphytotics in winter Wheat.**—*Plant Dis. Reptr.*, 39, 4, pp. 291–295, 2 maps, 1955. [Multilithed.]

Spring epiphytotics of wheat streak mosaic virus in Kansas have been predicted fairly accurately by sampling in late autumn and winter during five annual surveys [see above, p. 157]. These results and greenhouse inoculations [*R.A.M.*, 34, p. 713] indicate that the disease is severe only if infection occurs early in the preceding autumn.

Månsson (T.). **Gräsmjöldagg, Erysiphe graminis DC., på Vete.** [The grass mildew, *Erysiphe graminis* DC., on Wheat.]—*Sverig. Utsädesfören. Tidskr.*, 65, 3, pp. 220–241, 4 graphs, 1955. [English summary.]

Following an introductory account of the geographical distribution and economic importance of *Erysiphe graminis* and the relation of environmental factors to its development on wheat and barley, the author describes and tabulates the results of investigations at Svälöf in 1953–4 on resistance to the disease (which has assumed increasing importance of recent years in Sweden [*R.A.M.*, 32, p. 11 and above, p. 154]), as determined both by genetic constitution and the operation of environmental factors.

In 1954 the mean yield of 14 winter wheat varieties of the south Swedish group was 3,400 kg. per ha., representing a reduction of some 2,000 kg. as compared with two preceding years, while that of nine from central Sweden was 4,280 kg. per ha., i.e., 430 kg. less than in 1952 and 1953. The most resistant of all the Swedish varieties were Odin, Virtus, and Aros, while the indigenous Sammet, Sv 01473, and the Danish Trifolium 14 showed the highest degree of susceptibility. Infection

was more severe on light, sandy soils than on cold, heavy loams. In stands following rape growth was more luxuriant and disease incidence higher than in those following pasture grasses.

The use of nitrogenous soil amendments tends to enhance susceptibility to *E. graminis* [cf. 34, p. 442]. In a trial with calcium nitrate on four summer varieties Weibull's Pondus and Dala were much more heavily attacked at the maximum nitrogen level of 750 kg. per ha. than on the untreated plots, whereas the differences in Diamant II and Sv 01200 (especially the former) were not so noticeable. The differences are thought to be related to their growth rates. Another practice apt to increase susceptibility is early sowing. In tests on three winter varieties, Odin, Sammet, and Trifolium 14, and the summer wheat Dala, all the stands sown on 1st and 15th September were destroyed by the fungus, which was almost absent, on the other hand, from those of the latest sowing date (15th October). Sowing by hand to produce about 20 plants per m. results in a reduction of infection as compared with a drill (70 per m.).

Breeding for resistance is probably the most effective and practicable means of control, but its systematic pursuit would necessitate facilities for greenhouse inoculation experiments and a study of the physiologic races of the fungus occurring in Sweden, while a search must also be made for resistant varieties. Among those already available (besides the above-mentioned) are Hansa, Sv 01460 (Atle × Äring), and Ertus.

Of the various chemicals used in small-scale tests for powdery mildew control, lime-sulphur was the most efficacious [34, p. 779].

Winter barley also sustained heavy damage during the period of observation, the most susceptible lines being Sv Bore and its derivatives Bore II, Sv 48/4, and Sv 48/6, Sv 50/16 (Kaira × Mansholt), Vg 49/4, and Sv 50/17 (Peragis medium-early × Pomeranian Nordland).

Hiura (U.) & Heta (H.). **Studies on the disease resistance in Barley. III. Further studies on the physiologic races of Erysiphe graminis hordei in Japan.**—*Ber. Ōhara Inst.*, 10, 3, pp. 135–152, 4 pl., 1 diag., 1 graph, 1 map, 1955.

Using Goldfoil C.I. 928, Hanna C.I. 906, Heils Hanna 3 C.I. 682, Kairyo-bozo-mugi, Nakaizumi-zairai, and Nigrate C.I. 2444 as differential varieties, the writers isolated five new physiologic races of barley mildew (*Erysiphe graminis*) in Japan during 1953 and another in 1954, making 11 in all [*R.A.M.*, 33, p. 344].

Race 1 predominated, constituting 56 per cent. of all isolates, followed by 4 and 2, comprising 17 and 13 per cent., respectively. The proportions of the other race were very low. Geographically the 11 races fell into five groups, distributed (1) over practically the whole country (race 1); (2) mainly in the west (2 and 6); (3) principally in Hokuriku and adjacent regions (3, 4, and 7); (4) only Kanto-Tozan and Tohoku (5, 8, 10, and 11); and (5) consisting of race 9, the most important in Hokkaido.

On the basis of reaction to the foregoing 11 races of *E. graminis* in greenhouse inoculation experiments from 1953 to 1955, 170 barley varieties were divided into 21 groups. The Japanese varieties were further subdivided into three main types, viz., indigenous, most of which belong to group 3 (susceptible to all races, with some varieties moderately resistant to 8 and 9); varieties cultivated in the north comprising groups 7 and 10, the former susceptible to races 5 and 8, moderately resistant to 9, and resistant or semi-resistant to the remaining eight races, and the latter moderately resistant to 5, 8, and 9, and resistant to the others; and brewing barleys, assigned to groups 11, 12, and 13 (all highly resistant to races 1, 3, 5, 6, 10, and 11 but varying in response to the others).

From their pathogenicity and frequency, races 1, 4, and 9 would appear to be the fundamental and predominant races in Japan.

Arny (D. C.) & Leben (C.). **The effect of the water-soak seed treatment on the germination of certain Barley varieties grown at different locations.**—*Phytopathology*, 45, 9, pp. 518–519, 1955.

At the Wisconsin Agricultural Experiment Station samples of Kindred, Manchuria, Montcalm, Moore, and Wisconsin Barbless barley seed grown in 1953 at 16 locations in the Upper Mississippi Valley Spring Barley Nurseries, of Mars from eight of these, and of Oderbrucker from the State Department of Agriculture, were soaked in distilled water in open 125-ml. Erlenmeyer flasks at 22° to 25° C. for 56 hours as recommended by Tyner [*R.A.M.*, 33, p. 78] and modified by Hebert [34, p. 590] for the control of loose smut [*Ustilago nuda*].

The results of field tests in 1954 showed the treatment to be particularly detrimental to Kindred, the average germination of which was reduced from 96±4 per cent. in the untreated samples to 56±14. Wisconsin Barbless, on the other hand, was not seriously affected, germinating to the extent of 88±7 per cent. as against 93±4 for the untreated. The germination percentages for the other treated samples of the varieties ranged from 72±22 (Mars) to 81±14 (Manchuria) compared with 94±8 and 96±4, respectively, in the controls. The individual reactions are attributed to inherent varietal characteristics, the effect of locality of origin being apparently unimportant. Among the 96 samples harbouring loose smut, only 15 produced a few infected heads following the soak treatment; they were fairly evenly distributed among the seven varieties, with a rather larger number in Moore than in the others. The fact that samples from certain of the Valley nurseries, e.g., St. Paul and Waseca, Minnesota, were much more heavily damaged than those from Saginaw, Michigan, for example, is ascribed to such environmental conditions as would vary from year to year. The average number of smutted heads per 15-ft. row in the untreated samples ranged from none in those from De Kalb, Illinois, to 58 in the lot from St. Paul.

It is evident from these results that the impairment of germination by hot-water soaking may be serious unless offset by higher sowing rates. It is suggested therefore, that pre-planting germination tests be made on soaked seed.

Bruehl (G. W.). **Pythium root rot of Barley and Wheat.**—*Tech. Bull. U.S. Dep. Agric.* 1084, 24 pp., 1953. [Abs. in *Biol. Abstr.*, 28, 6, p. 1435, 1954.]

In an area of severe endemic root rot (*Pythium arrhenomanes*) [*R.A.M.*, 34, p. 592] of barley and wheat in South Dakota the outstanding symptom was the destruction of the fine rootlets, resulting in general debility. The local soil is low in available nitrogen and organic matter and good response was obtained from the application of nitrogen fertilizers and the use of legumes in crop rotations, without increased losses. A low order of varietal tolerance or resistance was demonstrated in barley.

Frey (K. J.) & Browning (J. A.). **Mutations for stem rust resistance induced in Oats by X-ray treatment.**—*Phytopathology*, 45, 9, pp. 490–492, 1955.

At the Iowa Agricultural Experiment Station in 1953 and 1954 a number of mutations conditioning resistance to races 7, 7A, and 8 (but not to 6) of stem rust (*Puccinia graminis*) were found in the X_3 progenies from seed of Huron oats irradiated with 25,000 r-units of X-rays and sown in the field at East Lansing, Michigan, in 1950 [cf. *R.A.M.*, 34, p. 223]. At least two of the 61 mutant lines were shown by genetic analyses to carry the Richland gene for stem rust resistance [cf. 35, p. 10]. From a study of the pathological data, resistance to race 8 (which occurred in only six of the mutants) appears to be based on possession of the White Tartar gene. Only one of the mutant lines seemed to carry one or two hitherto unknown factors conferring resistance to races 7 and 8 but not to 6 and 7A.

Grasso (V.). **A haplo-lethal deficiency in Ustilago kolleri.**—*Phytopathology*, 45, 9, pp. 521–522, 1 fig., 1955.

This is a joint report from the University of Minnesota and the State College of Washington on a sex-linked phenomenon first observed in a collection of *Ustilago kolleri* from oats at Parma, Italy.

The four sporidia from the promycelia of several germinating chlamydospores were cultured individually on potato dextrose agar. Two from each chlamydospore multiplied rapidly to produce normal monosporidial lines, whereas the other two ceased growth after budding a few times. Moreover, no fusions occurred on water agar between mixed sporidia from colonies initiated by the two rapidly multiplying sporidia, whether the lines originated from the same or from a different chlamydospore. On the other hand, when sporidia from colonies initiated by the same two sporidia were mixed with complete sets of four lines from three Italian collections and one from Minnesota, they fused with sporidia of one sex-compatibility group in each set. These results demonstrated that the rapidly multiplying sporidia of the Parma collection were of one sex group only. The lethal factor responsible for growth failure in the remaining sporidia appeared to be closely associated with the other sex group in *U. kolleri*. The haplo-lethal deficiency under observation is regarded as comparable with the phenomena reported in *U. bullata* [*R.A.M.*, 19, p. 600] and *Tilletia foetida* [30, p. 517].

Although the data tabulated in this paper might suggest that the Parma material is non-pathogenic, this is not so. It reproduces itself in a susceptible variety of oats on inoculation with chlamydospores. When masses of chlamydospores are germinated on an agar medium many aerial hyphae develop, resembling the dikaryotic ones resulting from the combination of compatible normal sporidial lines. It has not yet been determined, however, how these hyphae arise.

Jacks (H.) & Graham (G. J.). **Seed disinfection. XI. Control of head smut (Sorosporium reilianum (Kuhn) McAlpine) of Maize.**—*N.Z. J. Sci. Tech.*, Sect. A, 37, 2, pp. 141–145, 1955.

In further studies in this series [cf. *R.A.M.*, 34, p. 508] greenhouse and field trials were carried out by the Plant Diseases Division, Auckland, and the Extension Division, Department of Agriculture, Gisborne, New Zealand, for the control of maize head smut (*Sorosporium reilianum*) [*Sphacelotheca reiliana*: 31, p. 324], which in 1952 affected up to 22·4 per cent. of the plants in the Gisborne district. The results indicate that where crop rotation is impracticable the seed should be treated with agrosan GN, thirodust (50 per cent. thiram), or phygon XL (50 per cent. dichlone), all of which significantly reduced disease incidence. None of the treatments affected emergence except thirodust, which significantly increased it once, and cuprox which depressed it. Agrosan GN, agrimax M, phygon XL, and thirodust increased the final stand of the plants.

Moore (P. W.), Nauer (E.), & Yendol (W.). **Psorosis—Citrus enemy No. 1.**—*Calif. Citrogr.*, 40, 3, pp. 82–83, 92–93, 5 figs., 1 graph, 1955.

In 220 orange orchards in southern and central California 8 per cent. (15,100) of the mature trees had bark lesion symptoms of psorosis [*R.A.M.*, 33, p. 72 and next abstract] and were classified into four stages for the purpose of yield assessment. Stage 1 was the appearance of bark lesions on the trunk or of one or more limbs with a little die-back or top deterioration; 37 per cent. of the trees were in this state. Trees in stage 2 were subdivided into 2A with one main limb affected, 2B with two or three main limbs or up to one-third of the tree out of production, and 2C had up to half their bearing area destroyed. At stage 3, 50 to 75 per cent. of the bearing limbs were lost and the trees were considered submarginal producers; at stage 4 most of the original limbs had gone. The few fruits produced were

mostly on suckers springing from the trunk or from stubs of former scaffold limbs. Some trees were little more than stumps, practically without yield.

The average production of trees at each stage was calculated as a percentage of the average normal yield. While trees at stage 1 showed no significant difference (99·5 per cent.), the average yield of stage 2 was 65·1 per cent. (76, 60·6, and 47·4 per cent. in the three sub-classes, respectively), and stage 3, 28 per cent. A method is described of using the percentage yield factor for calculating potential long-term losses.

Orchard surveys twice a year, the early treatment of new cases, and the purchase of nursery trees grown from registered psorosis-free buds are recommended as a long-term insurance against future losses. A study of disease progress showed that 28·7 per cent. of the trees rated at stage 1 in 1945 had progressed to stages 3 and 4 by 1954; an additional 2·8 per cent. developed symptoms during the period.

Moore (P. W.) & Nauer (E.). **Psorosis takes a heavy toll.**—*Calif. Citrogr.*, 40. 4. pp. 152–153, 4 figs., 1955.

During a nine-year study of seven orange orchards from 36 to 56 years old in Los Angeles County observations were made on 875 trees with psorosis [*R.A.M.*, 32, p. 428] bark symptoms [cf. preceding abstract]. At the end only 37 out of 208 trees originally so classified remained in the early stages of the disease, the others having become advanced cases. The average production from scaly bark trees dropped from 2·8 to 1·9 boxes per tree, that for normal Valencia and navel trees being 3·7 and slightly under 4 per tree, respectively.

Weathers (L. G.), Calavan (E. C.), Wallace (J. M.), & Christiansen (D. W.). **Lemon on Troyer Citrange root.**—*Calif. Agric.*, 9. 11, pp. 11–12. 7 figs., 1955.

A new disorder of lemon trees grafted on Troyer citrange appeared in 1954 in Ventura, Santa Barbara, and Orange Counties, California [cf. *R.A.M.*, 34, p. 782]. The tops involved were all of the Eureka variety, the nucellar lines Frost, UCLA, Cook, and Hughes, and the old lines Allen, Hughes, and Cascade. Symptoms varied with the environment: Eureka tops turned yellow, set a heavy crop of fruit, and markedly declined, or sometimes died. The bud-union was found to be abnormal, the bark of the Troyer often having dried and adhered to the wood: both bark and wood necrosis occurred, accompanied by gumming and retarded growth. Affected wood was firm, dry, and stained light brown.

Fungi found on diseased trees were known to be normally only saprophytically associated and so far the cause of the disorder is unknown.

Bitancourt (A. A.). **Estudos sôbre a 'tristeza' das Citrus III. Experiências de transmissão.** [Studies on the 'tristeza' of Citrus III. Transmission experiments.]—*Arq. Inst. biol., S. Paulo*, 21 (*1952–54*), 7, pp. 57–64, 2 pl., 1954. [English summary.]

In the greenhouse at the Biological Institute, São Paulo, Brazil, 30 potted sweet orange plants grafted on sour orange were each infested at intervals between 13th March, 1944, and 23rd October, 1945, with lots of about ten *Aphis citricidus* each from tristeza diseased trees [*R.A.M.*, 30, pp. 412, 413], while another five plants were held as controls. No symptoms developed on any of the plants during a three-year period from the final infestations. Negative results were also obtained in a reciprocal budding test with the same combination made between November, 1944, and February, 1945.

In a third trial initiated from 27th to 29th December, 1948, using the bottle-graft method, twigs with three or four leaves were inserted in sweet orange scions on sour orange stocks. The 50 plants used were divided into five groups of ten, the material for grafting four of these groups (the fifth serving as a control) being

derived from the following sources: (1) healthy sweet orange plants grown from seed in the greenhouse; (2) tristeza-diseased sweet orange top of a composite tree grafted on sour orange stock; (3) symptomless sour orange top of the same tree; (4) symptomless sweet orange top on sweet orange stock from a diseased experimental orchard. After the plants had been in a lath house for a year those in group (1) and the ungrafted remained healthy, but in all the others infection had been successfully transmitted.

Moreira (S.). **A moléstia 'exocortis' e o cavalo de Limoeiro cravo.** [The 'exocortis' disease and the rough Lime rootstock.]—*Rev. Agric., Piracicaba*, 30, 4–6, pp. 99–112, 2 figs., 1955. [English summary.]

The symptoms of a disease prevalent in São Paulo, Brazil, among combinations of sweet orange and grapefruit scions on Rangpur lime stocks [cf. *R.A.M.*, 34, p. 642] are considered to leave no doubt as to its identity with exocortis [33, p. 421]. They develop at the age of two to three years and include stunting, gummosis and decortication below the bud union, sometimes involving the main roots, chlorosis, and off-season flowering. In an orchard of 536 six-year-old Hamlin oranges the incidence of infection was 42·6 per cent., one-third of the trees being severely damaged and 0·7 per cent. dead. Among five-year-old Pera trees in the same orchard there was 15·7 per cent. infection and 1·2 per cent. mortality. In another locality 90 per cent. of five- to six-year-old Bahianinha and of 13- to 14-year-old Barão trees were affected. Several clones of commercial sweet orange varieties were found to harbour the exocortis virus; on budding to Rangpur lime they induced symptoms in the rootstock. Nucellar clones from seeds of infected trees did not cause exocortis on Rangpur lime. Insect vectors do not appear to occur in the State.

The psorosis virus is present in many citrus clones in São Paulo [17, p. 595], sometimes in those which are also infected by exocortis, but no relationship could be established between the two diseases.

In future, only exocortis-free clones should be budded on the Rangpur lime. Affected scions may be restored to health by inarching with tolerant rootstocks, e.g., sweet orange and tangerine.

Roistacher (C. N.) & Klotz (L. J.). **A device for rapid inoculation of Citrus fruits.** —*Phytopathology*, 45, 9, pp. 517–518, 1 fig., 1 diag., 1955.

At the Citrus Experiment Station, University of California, Riverside, the inoculation of orange and lemon fruits with *Penicillium italicum* and *P. digitatum* [*R.A.M.*, 34, p. 641] has been facilitated by the use of a portable apparatus comprising a plexiglas container holding an aqueous suspension of inoculum and enclosing a circular saw blade projecting 1 mm. through a slit in the top. Rotating at a reduced speed of 210 revolutions per minute, the saw carries a film of spore suspension. In comprehensive tests an average of 98·4 per cent. infection was obtained.

Martyn (E. B.). **Diseases of Coconuts.**—*Trop. Agriculture, Trin.*, 32, 3, pp. 162–169, 1955.

The author shows that at least 6,000,000 acres of coco-nuts are required to produce the recorded world returns of copra, in relation to which the known losses due to diseases are negligible, but these are still a potential danger to any large-scale planting and cause heavy loss in certain areas. Attention is drawn to the apparent similarity of many minor diseases recorded from different parts of the world and to the difficulty of satisfactorily characterizing and naming many of the described pathogenic conditions, the causes of which are unknown. The only known lethal parasites of the coco-nut are *Phytophthora palmivora*, agent of bud rot,

[*R.A.M.*, 33, p. 590] and the eelworm, *Aphelenchoides cocophilus*, of red ring [*Trop. Agriculture, Trin.*, 30, pp. 1-3, 43-53, 1953]. There are, however, four serious epidemic diseases, the causes of which have yet to be discovered. They fall into two distinct categories with similarity of symptoms in each, the first comprising bronze leaf wilt [*R.A.M.*, 24, p. 367; 34, p. 19] and the 'unknown disease' [33, p. 294]; both kill the palm within four to six months and occur in and around the Caribbean, the former also being found in West Africa [34, p. 709; 35, p. 13]. The other two diseases are cadang-cadang [34, p. 92] and root disease of south India [34, p. 594], which have many features in common and result in a more gradual dying. It is suggested that more detailed and necessarily prolonged investigation of the botany of the coco-nut palm and its nutrient uptake is necessary to solve the mystery of these diseases, but that the solution to any one of them would greatly facilitate the unravelling of the others.

Willet (J. R.). **Verwerking van een enquete betreffende ziekten en plagen in de Koffiecultura.** [Analysis of an inquiry concerning diseases and pests in Coffee cultivation.]—*Bergcultures*, 24, 16, pp. 387, 389, 391, 393, 1955. [English and Indonesian summaries.]

In December, 1954, a questionnaire was addressed to the owners of 83 coffee estates in eastern Java concerning the incidence of diseases and pests. According to information in the 48 replies received, diseases were mostly of purely local importance. [Unspecified] root rots were mentioned in seven, top die-back [*R.A.M.*, 16, p. 670] in five, and djamur upas [pink disease = *Corticium salmonicolor*: loc. cit.] in two.

Van Suchtelen (N. J.). **Ziekten van de Koffie in Suriname.** [Diseases of Coffee in Surinam.]—*Surinaam. Landb.*, 3, pp. 297–305, 4 figs., 1955. [English summary.]

The Surinam coffee crop covers an area of some 1,800 ha. and is a valuable export; 95 per cent. is *Coffea liberica*, with a few beds or isolated fields of *C. canephora*, *C. robusta*, *C. abeocuta*, and interspecific crosses.

In general, diseases are comparatively unimportant. During the last 50 years the heaviest losses have been caused by *Ophiostoma coffeae* [*Ceratocystis fimbriata*; *R.A.M.*, 30, p. 366; 33, p. 80], which may destroy a tree in a few days, leaving the wilted leaves hanging. The external symptoms, however, are non-specific and might be due to a variety of causes. Most characteristic are the grey, sour-smelling patches in the wood, mostly of the stem base or root-collar, which together with the phloem is entirely permeated by dark hyphae and spores, causing the foliar wilt. Infection takes place through injuries, and in the case of adult trees a long period may elapse before wilting becomes noticeable. Under humid conditions perithecia are formed in profusion wherever the wood or phloem is exposed to the air, and give rise to large numbers of ascospores. Control presents a difficult problem. Fungicidal treatment of the injuries serving as infection courts would be uneconomic, and regular weeding of the plantations to produce a drier atmosphere, conducive to sporulation, is probably the most practical measure.

Very minor damage is caused by *Sclerotium coffeicola* [19, p. 326], *Cercospora coffeicola* [C.M.I. map No. 59], *Pellicularia* [*Corticium*] *koleroga* [No. 64], *C. salmonicolor* [No. 122], *Mycosphaerella coffeae*, and *Rhizoctonia* sp.

Jacques-Félix (H.). **Les parasites végétaux du Caféier signalés en Afrique.** [Plant parasites of the Coffee bush reported in Africa.]—*Bull. sci. Minist. Colon. Sect. Agric. trop.* 5 (Contribution à l'étude du Caféier en Côte d'Ivoire), pp. 393–456, 36 figs., 1954.

In this comprehensive, descriptive list of parasites observed on coffee in Africa

H. Jacques-Félix deals with vascular cryptogams, algae, and bacteria; G. Bouriquet, phycomycetes, proto-ascomycetes, and proto-basidomycetes; C. and Mireille Moreau, pyrenomycetes [*R.A.M.*, 31, p. 282]; Mme M. Jacques-Félix, autobasidiomycetes; and M. Luc, discomycetes. The fungi imperfecti are noted from the literature.

Delassus. **La trachéomycose du Caféier.** [Tracheomycosis of the Coffee bush.]—*Bull. sci. Minist. Colon. Sect. Agric. trop.* 5 (Contributions à l'étude du Caféier en Côte d'Ivoire), pp. 345–348, 1954.

The author reviews the history of coffee tracheomycosis (*Fusarium* [*Gibberella*] *xylarioides*) in Africa [*R.A.M.*, 34, p. 451 and following abstracts] where the disease now exists in all main coffee-growing areas. In any given region indigenous species suffer the most severely, a newly introduced variety remaining resistant for a few years only, after which it has to be replaced.

From a study of its morphological and biological characteristics the author concludes that the imperfect state of the pathogen [? from the Ivory Coast] agrees with the descriptions of both *F. xylarioides* [30, p. 228] and *F. oxysporum* [29, p. 618]. He therefore proposes the name *F. oxysporum* f. *xylarioides* n. comb.

Gaps of a few hundred metres suffice to confine an epiphytotic to the affected plantation, but when plantations touch, the disease gradually spreads; between Issia and Daloa the focus of infection moved 50 km. in two years. Control methods should be directed mainly towards the production of resistant varieties and the improvement of cultural conditions.

Jacques-Félix (H.). **La carbuncullariose.** [Carbuncullariosis.]—*Bull. sci. Minist. Colon. Sect. Agric. trop.* 5 (Contributions à l'étude du Caféier en Côte d'Ivoire), pp. 296–344, 17 figs., 1 map, 1954.

This is a detailed account of carbuncullariosis (*Gibberella xylarioides*) of coffee, which has caused considerable damage in the Ivory Coast during recent years [see preceding and following abstracts]. The pathogen is endemic as a saprophyte in all intertropical African soils under forest or cultivation, invading the coffee bush through wounds. Avoidance of root wounds and treatment with antiseptics are effective in limiting the spread of the disease. The fungus increases in virulence as it becomes adapted to grow on dead tissues by neutralizing the metabolites. The incubation period, very long at first, is progressively reduced if certain conditions, such as crowding in the plantation, obtain. Conidia and ascospores are dispersed by rain, wind, and particularly by human traffic. Infection, at first limited by the concentration of the fungus in the soil, becomes dependent instead on the number of lesions open for invasion. Eradication of infected coffee and prohibition of the transport of diseased material are the basic precautions against disease spread. It is important to ameliorate extremes of temperature and humidity in the plantation. Cultivation methods leading to loss of organic matter probably increase the population of *G. xylarioides*; soil conditioning in favour of antagonistic fungi, or soil disinfection, may be advisable.

Moreau (C.) & Moreau (Mireille). **Étude morphologique de Gibberella xylarioides (Stey.) Heim et Saccas.** [Morphological study of *Gibberella xylarioides* (Stey.) Heim & Saccas.]—*Bull. sci. Minist. Colon. Sect. Agric. trop.* 5 (Contributions à l'étude du Caféier en Côte d'Ivoire), pp. 349–359, 3 figs., 1954.

The authors give a detailed description of *Gibberella xylarioides* isolated from infected coffee stems from the Ivory Coast [see preceding and following abstracts] and brief notes on other species of the Hypocreales parasitic or saprophytic on coffee, recorded in the literature.

Rabéchault (H.). **Les pigments du Fusarium xylarioides.** [The pigments of *Fusarium xylarioides*.]—*Bull. sci. Minist. Colon. Sect. Agric. trop.* 5 (Contributions à l'étude du Caféier en Côte d'Ivoire), pp. 360–362, 1954.

At the Botanical Laboratory of the Technical Section of Tropical Agriculture, Paris, a red pigment in agar cultures of *Gibberella xylarioides* from coffee [see preceding and following abstracts] was identified as rubrofusarin; on sudden refrigeration at −5° C. a green pigment was observed; and very small quantities of an indigo pigment appeared in a liquid medium at 27°.

Rabéchault (H.). **Sur quelques facteurs de résistance du Caféier à la trachéomycose.** [On some resistance factors of the Coffee bush to tracheomycosis.]—*Bull. sci. Minist. Colon. Sect. Agric. trop.* 5 (Contributions à l'étude du Caféier en Côte d'Ivoire), pp. 282–286, 3 figs., 1954.

In experiments at the Botanical Laboratory of the Technical Section of Tropical Agriculture, Paris, on the factors responsible for the resistance of coffee to tracheomycosis (*Fusarium* [*Gibberella*] *xylarioides*) [see preceding and following abstracts], caffeine at concentrations above 1·75 per cent. inhibited the growth of mycelium in liquid culture. The caffeine content has been shown to vary according to the species, being particularly high in *Coffea canephora*, and in any one species to depend on the type and age of the organ, on the origin of the plant, and on cultural conditions. When blotting-paper disks soaked in ether extracts of various coffee tissues were placed on agar cultures of *G. xylarioides*, extracts of *C. canephora* (Robusta) caused measurable inhibition; with *C. liberica* (Indénié) the effect was slight or absent. The identity of the inhibitory substance is not known.

Nicot (J[acqueline]). **Inventaire de la microflore de terres à Caféiers en Côte d'Ivoire.** [Inventory of the microflora of soils planted with Coffee in the Ivory Coast.]—*Bull. sci. Minist. Colon. Sect. Agric. trop.* 5 (Contributions à l'étude du Caféier en Côte d'Ivoire), pp. 287–291, 1954.

As a result of isolations from 29 soil samples from coffee areas in the Ivory Coast, including both healthy plantations and those infected by *Fusarium* [*Gibberella*] *xylarioides* [*R.A.M.*, 34, p. 179 and preceding and next abstracts], 45 fungi are tabulated, their interactions with the pathogen being indicated. *Aspergillus flavipes*, *Penicillium multicolor*, and *Trichoderma viride* [cf. next abstract] inhibited the growth in culture of *G. xylarioides*. *T. viride* was isolated from 17 out of 22 samples from healthy plantations and from two out of seven from diseased ones. It is pointed out that, since the less rapidly growing isolates tend to be masked in culture by fungi such as *T. viride*, the results are inconclusive.

Rabéchault (H.). **Sur quelques faits d'antagonismes observés dans la microflore de la Caféière.** [On some cases of antagonism observed in the microflora of the Coffee plantation.]—*Bull. sci. Minist. Colon. Sect. Agric. trop.* 5 (Contributions à l'étude du Caféier en Côte d'Ivoire), pp. 292–295, 1 fig., 1954.

Additional isolates found to inhibit the growth in culture of *Fusarium* [*Gibberella*] *xylarioides* [see preceding abstracts] included the soil fungi *Penicillium notatum* and *P. lilacinum* and, from coffee bushes, four actinomycetes, one bacterium, and species of *Corticium*, *Marasmius*, and *Trichoderma*.

Karpova-Benua (Mme E. I.). О токсичных грибах на волокне Хлопка. [Concerning toxic fungi on Cotton fibre.]—Бот. Журн. [*J. Bot. U.S.S.R.* = *Bot. Zh. S.S.S.R.*], **39**, 4, pp. 488–497, 1 pl., 3 figs., 1954.

At the Ivanovsky Agricultural Institute, U.S.S.R., 42 species of mould fungi, including *Dendrodochium toxicum*, *Stachybotrys alternans*, *Aspergillus niger*, *A. nidulans*, *A. fumigatus*, *A. versicolor*, and *A. herbariorum*, were found to damage

fibres obtained from poorly selected, badly cleaned, and insufficiently dried raw cotton. There is evidence that persons employed in cotton concerns may be affected by mycosis if the cotton is infected by pathogenic fungi, *D. toxicum* in particular.

Orlandi (L.). **Azione di antibiotici su colture di Botrytis bassiana Bals.** [The action of antibiotics on cultures of *Botrytis bassiana* Bals.]—*Ann. Sper. agr.*, N.S., 8, 3, pp. 887–892, 1954. [English summary.]

At the Experimental Station for Mulberry and Silkworm Culture, Ascoli Piceno, Italy, penicillin and streptomycin at strengths up to 1 per cent. had no effect on the spore development of *Botrytis* [*Beauveria*] *bassiana* [*R.A.M.*, 32, p. 557], while aureomycin at 1, 0·5, and 0·1 per cent. and tyrotricin at 0·05, 0·01, and 0·005 per cent. strongly inhibited it. Chloramphenicol and terramycin sometimes retarded or inhibited growth.

Steinhaus (E. A.). **The effects of disease on insect populations.**—*Hilgardia*, 23, 9, pp. 197–261, 2 graphs, 1954.

An account is given, principally from the literature (over seven pages of references), of insect populations as influenced by infectious diseases, with special emphasis on disease dynamics and the role of disease in the natural control of insects. Disease-producing micro-organisms are regarded as density-dependent mortality factors. Weather conditions, equally favourable for the insect and disease development, influence epizootics indirectly through the host insect. Naturally and artificially disseminated diseases, while not completely exterminating an insect species, can reduce populations by 95 to 99 per cent. The functioning of micro-organisms differs in some respects from that of parasites and predators and only in certain instances can micro-organisms be established in the same manner as insect parasites and predators, for micro-organisms are usually applied in the same manner as insecticides. It is usually more difficult to establish pathogens than insects, though it has been done successfully in some cases. The mode of transmission or dissemination of a pathogen (or its capacity to spread) plays an important role in the epizootiology of disease in insect populations.

An appendix gives the types of relationships existing between micro-organisms and insects.

Fröier (K.). **Svalöfs nya Spånadslinsorter och deras praktiska betydelse.** [Svalöf's new fibre Flax varieties and their practical importance.]—*Sverig. Utsädesfören. Tidskr.*, 65, 6, pp. 402–417, 3 maps, 1955. [English summary.]

Included in this informative account of the industrialization of the Swedish flax-growing industry during and since the second world war are observations on the resistance to rust [*Melampsora lini*: *R.A.M.*, 29, p. 213] of some superior new varieties bred by the Swedish Seed Association, Svalöf, e.g., Herkules and Gerda, and of the Dutch Wiera (Concurrent × Herkules). The last-named should prove valuable as a substitute for the susceptible Concurrent.

Costa (A. S.). **Studies of Abutilon mosaic in Brazil.**—*Phytopath. Z.*, 24, 1, pp. 97–112, 3 figs., 1955.

Abutilon mosaic [variegation] virus [*R.A.M.*, 34, p. 151], widespread among indigenous species of *Sida* and other Malvaceae in São Paulo and elsewhere in Brazil [23, p. 439; 26, p. 547], has been shown to be likewise responsible for the natural occurrence of mosaic in cotton, *Hibiscus esculentus*, field bean (*Phaseolus vulgaris*), and soy-bean. It was further transmitted in experiments with the white fly vector, *Bemisia tabaci* (mixed in some cases with *B. inconspicua*, not yet known to be a carrier), to hollyhock, *H. cannabinus*, groundnut, *Cyamopsis tetragonaloba*, lentil, white lupin, *Nicandra physaloides*, and potato. Recovery of the virus from *H. esculentus*, *S. micrantha*, *S. rhombifolia*, bean, soy-bean, and potato was effected

by means of white flies reared on *Euphorbia prunifolia*. An infection feeding of 24 to 48 hours was given, *S. micrantha* and *S. rhombifolia* then being used as test plants. The symptoms induced by *Abutilon* variegation virus in *S.* spp., cotton, bean, soy-bean, potato, and *H. cannabinus* are briefly described.

Cotton plants were readily inoculated when the viruliferous insects were fed on the young true leaves, whereas feeding on the cotyledons only seldom resulted in infection. No evidence of seed transmission of the virus was obtained and all attempts to convey it mechanically from diseased to healthy plants were unsuccessful. The white flies appeared unable to acquire virus from diseased cotton plants, suggesting that the spread of mosaic from cotton to cotton is rare and that most of the field infection in this host and *H. esculentus* proceeds from the movement of viruliferous vectors from weeds of the same family, such as *S.* spp.

The results of further cross-inoculation tests and observations confirmed the conclusion already reached that the *Euphorbia* mosaic virus previously described from Brazil [29, p. 493] is distinct from *Abutilon* variegation virus. Thus, the latter was not transmitted by large numbers of *B. tabaci* to *E. prunifolia* and *Datura stramonium*, both good hosts of the former, nor did they transfer the *Euphorbia* mosaic virus from *E. prunifolia* to cotton and *S.* spp.

Reeder (E. T.) & Vanterpool (T. C.). **Phoma spp. on Flax in Saskatchewan.**—Abs. in *Proc. Canad. phytopath. Soc.*, 21, p. 16, 1953.

At the University of Saskatchewan, Saskatoon, *Phoma exigua* [*R.A.M.*, 26, p. 8; 32, p. 187] isolated from flax seed, but rarely found on growing flax, reduced germination 75 per cent. by pre-emergence killing. Moderate resistance was shown only by Victory flax. The fungus overwinters on flax stubble. In liquid culture it produces a substance inhibiting germination. *P. conidiogena* isolated from bolls and seeds and *Ascochyta* spp. commonly isolated were non-pathogenic to flax.

Comparative studies with species of these genera associated with flax root rot from the British Isles [32, p. 625] and Canada led the authors to conclude that two Scottish isolates [loc. cit.], one from Northern Ireland, and *A. linicola* from the Bureau voor Schimmelcultures, Baarn, Holland, should be included in *P. lini* owing to the absence or low percentage (1 to 4) of two-celled spores. *P. lini* has not been found in Western Canada.

Elliott (E. S.). **Notes on diseases of cereals and ornamentals recorded in West Virginia during 1953 and 1954.**—*Plant Dis. Reptr*, 39, 4, pp. 332–333, 1955. [Multilithed.]

A list is given of a number of diseases of cereals and ornamentals recorded during 1953 and 1954 in West Virginia. *Botryosphaeria ribis* var. *chromogena* occurred commonly on *Cercis canadensis* [*R.A.M.*, 30, p. 129] in some areas, causing extensive die-back. *Elsinoe corni* was recorded in 1954 on *Cornus florida* [34, p. 371] in Wayne county. A number of peony varieties in one locality were affected by *Gloeosporium* anthracnose [? *Glomerella cingulata*: 23, p. 19].

Carpenter (T. R.) & Gammon (E. T.). **Methyl bromide gas treatments of dormant Gladiolus corms and of sclerotia of Sclerotium rolfsii.**—*Phytopathology*, 45, 9, pp. 520–521, 1955.

Joint experiments were conducted in January, 1954, by the Bureaux of Plant Pathology and Entomology, California Department of Agriculture, to determine the tolerances of methyl bromide gas of dormant gladiolus corms and *Sclerotium rolfsii* sclerotia, which were treated simultaneously at rates of 3, 5, 7·5, 10, 15, and 20 lb. per 1,000 cu. ft. of air space. Each treatment was carried out at 27° C. and 60 per cent. relative humidity and lasted four hours.

According to a report received in the following November, no differences in

emergence, growth or production were observed between the untreated corms and those exposed to the gas at a concentration of 3 lb. per 1,000 cu. ft. but it was found that dormant gladiolus corms are intolerant of methyl bromide gas at the concentrations requisite to destroy the sclerotia of *S. rolfsii*.

Scurti (Jole C.). **Le colture industriali dei Gladioli e le malattie che le insidiano.** [Commercial plantings of Gladioli and the diseases which affect them.]—*Ann. Sper. agr.*, N.S., 9, 1, *Suppl.*, pp. xcvii–cvi, 1955. [English summary.]

After a short account of the commercial importance of gladiolus cultivation in Italy, the author gives notes, based on her own studies, on the symptoms and control of the chief fungal, bacterial, and virus diseases affecting the crop locally. The most important disease is *Fusarium* yellows (*F. orthoceras* var. *gladioli*) [*F. oxysporum* f. *gladioli*: *R.A.M.*, 32, p. 562], but the following are also widespread: dry rot (*F. oxysporum* var. [f.] *gladioli*) [30, p. 107], storage rot (*Penicillium gladioli*) [34, p. 46], leaf spot and corm rot (*Septoria gladioli*) [29, p. 261], and the corm rot due to *Botrytis gladiolorum* [34, p. 725]. Less serious are smut (*Tuburcinia gladioli*) [*Urocystis gladiolicola*: cf. 32, p. 483] and bacterial scab (*Pseudomonas marginata*) [cf. 30, p. 161]. The most prevalent virus disease is mosaic [29, p. 261], but it is not serious.

Some varieties, especially Picardy, are affected by a disease probably due to a virus. Healthy corms give rise to plants with weak spikes bearing small flowers or none. The roots which develop from new corms remain thin. The colour of the flowers is affected, and in the Picardy variety they become greenish. The breaking and spotting of white break mosaic of America [cf. 23, p. 488] are absent, and there is curving of the floral axis. The disease is apparently not of fungal or bacterial origin, but inoculations of healthy plants with sap from those affected have so far given negative results. A bibliography of 34 titles is appended.

Milatović (Ivanka). **Fuzarijska trulež lukovica Gladiola.** [*Fusarium* rot of Gladiolus corms.]—*Zasht. Bilja* (*Plant Prot., Beograd*), *1955*, 28, pp. 93–98, 1 fig., 1955. [English summary.]

During the winters of 1951–2 and 1953–4 *Fusarium oxysporum* var. [f.] *gladioli* was isolated from stored Picardy, Primulinus, and Gorica gladiolus corms [*R.A.M.*, 34, p. 135] at Zagreb, Yugoslavia. The disease is believed to have been present in the country for a considerable time. Control measures include proper agricultural practices and spraying with mercury preparations in spring and autumn.

Schenk (P. K.). **Een bladvlekkenziekte van de Gladiool, veroorzaakt door Stemphylium botryosum Wallr.** [A leaf spot disease of Gladiolus caused by *Stemphylium botryosum* Wallr.]—*Tijdschr. PlZiekt.*, 61, 5, pp. 154–158, 2 figs., 1955. [English summary.]

During 1953 and 1954 *Stemphylium botryosum* [the conidial state of *Pleospora herbarum*] was observed to be causing a serious leaf spot of gladiolus in Holland. The disease, which reduces the size of the corms, was apparently observed by Timmermans in 1931 but no record was published. It has also been reported from the United States [*R.A.M.*, 32, p. 190], Italy [29, p. 261], and Australia [34, p. 787]. The spots are typically circular, yellow or pale green, and 1 to 3 mm. in diameter; a red-brown dot to one side marks the point of entry of a germinating spore. Sometimes the lesions are larger and irregular, several dots merging into a white, necrotic spot, becoming round to elongated, dirty white, later light brown, and sometimes surrounded by yellow tissue. The outer leaves are infected first, and in severe cases the entire leaf is killed from the top downwards, while the death of the whole plant may ensue under unfavourable conditions. Flowering is suppressed by a very early attack.

The pathogenicity of the fungus was established by the inoculation of eight- and ten-week-old plants of the highly susceptible Picardy variety. Another very susceptible variety is Harry Hopkins, while infection has also been observed on Rebecca West, Blazing Fire, Salmans Glory, Golden Emblem, and Odness. In some varieties, e.g., Van Tienhoven, resistance appears to diminish with advancing age. Pending further investigations on control, spraying with zinc carbamate is recommended.

Bruhn (C.). **Untersuchungen über die Botrytis-Krankheit der Gladiolen (Erreger : Botrytis gladiolorum Timmermans).** [Studies on the *Botrytis* disease of Gladioli (agent: *Botrytis gladiolorum* Timmermans).]—*Phytopath. Z.*, 24, 2, pp. 179–194, 8 figs., 1 graph, 1955.

Comprehensive studies are reported from the Biological Institute, Berlin-Dahlem, on the gladiolus corm rot caused by *Botrytis gladiolorum* [cf. *R.A.M.*, 34, p. 38], which has been present in Germany since about 1950 and is now widespread throughout the country, attacking all the principal commercial varieties. The fungus was also isolated from *Acidanthera* corms imported from Holland [29, p. 141] and caused typical decay on inoculation into corms of its own host and gladiolus. The control measures practised in other countries are summarized with a view to trials of their efficiency under German conditions. Tests with four gladiolus varieties in 1953 demonstrated that less disease developed (4 per cent.) when the corms were dried in a special drying room at a constant temperature of 35° C. before storing in a dry cellar at 5° to 10° than when the drying was carried out in a greenhouse at 15° to 20° (16 per cent.).

Lihnell (D.). **Något om virussjukdomer hos Liljor.** [Something about virus diseases of Lilies.]—*Växtskyddsnotiser, Stockh., 1955*, 2, pp. 21–27, 3 figs., 1955.

Two of the lily viroses [*R.A.M.*, 33, p. 424] herein described from Sweden, mosaic and rosette [C.M.I. map No. 103], have already been reported from that country [*R.A.M.*, 16, p. 752]; the third is necrotic fleck [24, p. 18]. Discussing control measures, the author emphasizes the paramount importance of clean planting material; aphicidal treatment in the field, though valuable, cannot entirely prevent the spread of infection. Bulbs purchased on the open market should be accompanied by a guarantee that the seller has observed the necessary precautions to ensure freedom from infection; in doubtful cases the plants should be grown in isolation from other lilies for the first year.

Wade (G. C.). **Rose diseases in Tasmania.**—*Tasm. J. Agric.*, 26, 2, pp. 135–141, 8 figs., 1955.

Brief notes are given on the symptoms and control of rose diseases in Tasmania. Rose wilt virus [*R.A.M.*, 10, p. 733; 34, p. 283] causes a general weakening of the plant, with a die-back of some shoots, usually accompanied by vein clearing and sometimes mottling of the leaves, and it is also characterized by the downward curling of the leaflets. Ophelia is one of the most susceptible varieties. Affected bushes should be burned and care exercised in selecting healthy propagating material. Anthracnose (*Sphaceloma rosarum*) [32, p. 628] is first evident as small watersoaked spots on leaf and stem, later becoming dry and grey in the centre, with a purplish border. Effective control may be obtained with thiram or zineb sprays. Lorraine Lee is very susceptible. In the spring, following cold periods, bacterial blight (*Pseudomonas syringae*) [15, p. 23] is often severe, killing the immature petals within the buds, and causing sunken, watersoaked spots on leaves and stems. The other diseases dealt with are canker (*Leptosphaeria coniothyrium*), crown gall (*Bacterium* [*Agrobacterium*] *tumefaciens*), powdery mildew (*Sphaerotheca pannosa*),

black spot (*Diplocarpon rosae*), rust (*Phragmidium* sp.), and *Botrytis* blight (*B. cinerea*). It is also noted that roses are highly susceptible to damage by hormone weed killers.

Stahl (Marianne). **Eine neu eingeschleppte Bakteriose der Edelnelken.** [A newly introduced bacteriosis of Carnations.]—*Pflanzenschutz*, 7, 8, pp. 119–120, 2 figs., 1955.

In the spring of 1955, Harvest Moon carnation cuttings imported from Denmark into the Stuttgart district of Germany were found to be infected by a bacteriosis tentatively attributed to *Pseudomonas caryophylli* [*R.A.M.*, 34, p. 524] on the basis of symptoms and morphology in agar culture of the causal organism. There is, however, one conspicuous feature of the newly observed disease which is absent from the wilt caused by *P. caryophylli*, i.e., a copious exudation of milk-white mucilage from cut stems or leaf veins. Infection spread rapidly to the Sim varieties already being cultivated in the nurseries.

Lelliott (R. A.) & Wallace (Maud M.). **A bacterial disease of Shirley Poppies in Tanganyika.**—*Trans. Brit. mycol. Soc.*, 38, 1, pp. 88–91, 1 pl., 1955.

A bacterial disease of Shirley poppy (*Papaver rhoeas*) [cf. *R.A.M.*, 30, p. 142] was first observed near Moshi, Tanganyika, in July, 1944, and has since occurred annually from July to September with varying severity in the same beds. Sometimes the first symptom is a purplish-black stem discoloration at or near soil-level, turning black and spreading upwards to the branch tips, involving either the whole stem or initially one side only. The foliage wilts, turns yellow and then brown, with the veins appearing as black lines, and finally disintegrates into a malodorous slimy mass. Alternatively, black spots appear in the leaf veins or blades or on the lateral branches well above soil level, either spreading to kill the plant or remaining localized. Plants are attacked at all ages, well-grown plants being killed outright in a week or two or even within a few days.

In preliminary infection experiments in 1944 the typical discoloration was produced 24 hours after healthy stems had been needle inoculated. In 1950 typical leaf spots developed in young plants 48 hours after they were sprayed with a bacterial suspension. Needle punctures into the veins produced infection after the same time; after four days the lesions measured up to 11·5 cm. long and infection had penetrated the leaf blades. In some cases the crowns were affected and the plants died. The bacterium was reisolated from inoculated plants. Other types of plant could not be infected but inoculated young Oriental poppies (*P. orientale*) developed symptoms similar to those on *P. rhoeas*.

The bacterium, a non-lipolytic, Gram-negative, rod-shaped aerobe measuring on an average 2 by 0·4 μ and motile with one to several flagella, is named *Pseudomonas papaveris* n.sp. Gelatin was not liquefied, nitrite not produced from nitrate, neither indole nor hydrogen sulphide produced, starch partially hydrolysed, and acid produced from xylose, dextrose, mannose, glycerol, maltose, and lactose but not from rhamnose, sucrose, raffinose, or salicin. The optimum growth temperature was 25° to 30° C., maximum 35°, and the thermal death point 49° to 50° after ten minutes' exposure.

Verma (G. S.) & Bose (A. K.). **Chlorosis of Salvia coccinia Linn.**—*Indian Phytopath.*, 8, 1, pp. 76–77, 2 figs., 1955.

During the late winter of 1952 a few garden plants of *Salvia coccinia* [*S. coccinea*] showed symptoms believed to be of virus origin. Vein-clearing was followed by the appearance of bright yellow leaf spots, which enlarged and coalesced to form continuous yellow patches, finally covering the whole leaf, and accompanied by dwarfing, distortion, leaf curling, and general stunting of the plants. At the Botany

Department, Lucknow University, India, the disease was readily transmitted to healthy *Salvia* plants by bud and cleft grafts, the yellow spots appearing in about three weeks but with no noticeable distortion or stunting. The symptoms agree most closely with those reported on *S. splendens* in Belgium [caused by *Salvia* virus 1: *R.A.M.*, 29, p. 620].

Dimock (A. W.) & McFadden (L. A.). **Bacterial Mum disease discovered by Cornell University pathologists ; causes black rotting.**—*Flor. Rev.*, 114, 2944, pp. 17–18, 3 figs., 1954.

This is a further account [cf. *R.A.M.*, 33, p. 355] of the bacterial blight of chrysanthemum caused by *Erwinia chrysanthemi* in the United States [34, p. 370]. Many variations from the typical symptoms are reported, marginal leaf scorching sometimes being the only indication of the disease. Usually the roots of the affected plants are not conspicuously rotted, though sometimes there may be extensive damage. Often the disease affects one branch only or is confined to the upper part of the stem with healthy shoots developing from the base and producing normal flowers. Sometimes affected plants are symptomless externally.

Beside those already noted [loc. cit.], the following plants were found to be susceptible in inoculation experiments: *Chrysanthemum frutescens*, *C. leucanthemum*, *C. coronarium*, *C. cinerariifolium*, New York and New England Michaelmas daisies (*Aster novibelgi* and *A. novaeangliae*), *Anthemis tinctoria*, *Amaranthus retroflexus*, and wild golden rod (*Solidago* sp.).

Using cuttings from infected but symptomless plants is mainly responsible for the spread of the disease, which can also occur through pinching wounds, root injury with cultivating tools, using older plants as stock, dipping infected and healthy cuttings in the same solution, and through hydroponic culture. Laboratory experiments showed that the bacterium survives in the soil for several months.

A yearly sterilization of the soil is recommended, irrespective of whether the disease is present or not; immediate disinfection should follow any crop showing signs of the disease. Pinching, flower removal, and cutting should be done by snapping off and not using a knife or the finger nails. Cuttings should be dipped only in a safe bacterial additive [loc. cit.].

Munnecke (D. E.) & Chandler (P. A.). **Disease-free Geranium stock.**—*Calif. Agric.*, 9, 5, pp. 8, 14, 4 figs., 1955.

Besides bacterial stem rot and leaf spot (*Xanthomonas pelargonii*) of geranium (*Pelargonium hortorum*) in California [*R.A.M.*, 34, p. 369] leaf curl and mosaic viruses [20, p. 304] also cause losses of cuttings, though they are often overlooked as their symptoms are less obvious. To secure virus-free propagating stock a 'mother-block' is built up from selected symptomless cuttings, propagated in individual pots and discarded if the slightest abnormality appears within a year. From the various varieties healthy cuttings are then planted in raised beds in soil previously steamed or treated with chloropicrin (3 ml. on 12-in. centres) or methyl bromide (4 lb. per 100 cu. ft. of space beneath a cover); the plants must be kept insect-free and rogued.

Rooted cuttings are used for the 'increase-block', also established with chemically treated soil and kept equally insect-free. On the appearance of virus symptoms the 'mother-block' plant and all descendants should be destroyed. If a field planting becomes diseased, replanting should be delayed for three months, cuttings being taken from the increase-block.

Cutting instruments should be kept in 1 in 1,000 mercuric chloride solution, and after use should be disinfected and wiped dry before being used on a fresh plant; operators should wear rubber gloves; overhead watering should be avoided.

To reduce grey mould [*Botrytis cinerea*: cf. 31, p. 386] flowers should be removed from the 'mother-' and 'increase-blocks'.

Growers adopting this procedure have found that culture can be much more intensive and on a smaller acreage as yields are far higher.

HANSON (C. A.). **Camellia flower blight in Southern California.**—*Camellian*, 6, 3, pp. 5, 29, 1955.

All species and varieties of camellias have been found to be equally susceptible to flower blight (*Sclerotinia camelliae*) [*R.A.M.*, 34, p. 456]. During the spring of 1955 applications of captan (2 lb. per 100 gals.) as soil drenches in nurseries in southern California reduced the incidence of flower blight by as much as 90 per cent. The best control was achieved by fortnightly sprays during the flowering period or more frequently after rain.

ITÔ (K.), CHIBA (O.), ONO (K.), & HOSAKA (Y.). **Pestalotia disease of Camellia japonica L.**—*Bull. For. Exp. Sta. Meguro* 70, pp. 103–128, 4 pl., 5 figs., 1954. [Japanese, with English summary.]

From morphological and physiological comparisons it was concluded that isolates of a *Pestalotia* sp. [cf. *R.A.M.*, 27, p. 126] from young fruits and leaves of *Camellia japonica* growing in Toshima and Niijima, Japan, were identical with each other and with *P. guepini*, the causal agent of grey blight of tea and *C. japonica*. The isolates from *C. japonica* were pathogenic to wounded tea and *C. japonica*, had an optimum growth temperature of 22° C. and an optimum pH of 5 to 7, the optima for conidial formation being 25° and pH 5·4 to 7·8. Germination was inhibited above 30° and was optimum from 25° to 28° and at pH 8.

VAN KATWIJK (W.). **Ringvlekkenmozaiek bij Seringen in Nederland.** [Ring spot mosaic of Lilacs in Holland.]—*Meded. Dir. Tuinb.*, 18, 10, pp. 823–828, 5 figs., 1955. [English summary.]

The symptoms of the ring spot virus occurring on lilac in Holland are stated to agree with those described by Atanasoff from Bulgaria [*R.A.M.*, 14, p. 462], Illitschetsky from the Ukraine, U.S.S.R. [19, p. 303], Smolák & Novák from Czechoslovakia [30, p. 520], Beale & Beale in the United States [35, p. 89], Protsento & Protsento from the U.S.S.R. [32, p. 434], and Nikolić & Milinkó from Yugoslavia [31, p. 328]. They include pale green to yellow spots, narrow, well-defined lines, and broad, diffuse rings and bands on the leaves, the last-named often accompanied by serious distortion and the development of fissures and holes in the discoloured tissues. Large areas separated by a band may show a pale green to yellow discoloration. Contrary to the observations reported from other countries, the last-named symptom is always found near the leaf tip.

The virus appears to be spread principally by grafting material, so that stringent selection in the nursery is essential.

RAABE (R. D.) & SCIARONI (R. H.). **Petal blight disease of Azaleas.**—*Calif. Agric.*, 9, 5, pp. 7, 14, 3 figs., 1955.

Azalea [*Rhododendron*] petal blight (*Ovulinia* [*azaleae*: cf. *R.A.M.*, 20, p. 119; 29, p. 510; 34, p. 153]) appeared in California in 1940; it has spread and is now causing concern. Small round spots on the petals rapidly grow into irregular, rusty brown or faded, tan-coloured blotches until the flower collapses; infected tissues become soft and mushy; infected buds fail to open. Small, black, disk-shaped sclerotia formed inside the flowers fall with these to the ground and overwinter in the soil. In the following season spores ejected from apothecia are carried by wind to infect the petals. Cool, rainy weather favours the disease.

Control is difficult and rendered more so by the rapid succession of bloom. Spraying three times a week during the cooler part of the day with parzate or dithane Z-78 (12 oz. per 100 gals. water plus spreader-sticker) is recommended. Infected flowers should be destroyed. Ground sprays of fermate (6 lb. per 1,000 sq. ft.) before flowering destroy the ascospores; so does mulching; another precaution is not to splash when watering.

Disease-free plants for forcing can be maintained in the greenhouse by removal of all flowers and buds beginning to colour; removal and replacement of the surface litter helps to eliminate ascospores. Reduction of humidity in the greenhouse to 80 or 85 per cent. will kill the secondary spores. Entry of the fungus into a planting can be prevented by ensuring that new plants are flowerless and bare-rooted.

Durbin (R. D.), Davis (Lily H.), & Baker (K. F.). **A Helminthosporium stem rot of Cacti.**—*Phytopathology*. 45. 9. pp. 509–512. 2 figs.. 1955.

The initial symptoms of a top or basal rot of cacti caused by *Helminthosporium cactivorum* in southern Californian nurseries are well-defined. yellow lesions. which rapidly expand, turning dull dark green and watersoaked or dark brown. The plants are killed in two to four days. the final stage being a shrunken. dark brown mummy covered with conidia. Older plants are invaded through stomata or wounds, while direct penetration is also common in young ones. The intercellular. hyaline, densely granular mycelium, which may easily be confused with that of *R*[*hizoctonia*] [*Corticium*] *solani*, aggregates in the subepidermal tissues into parallel rows of hyphae forming light brown stromatic masses and these in turn give rise to erect, elongated, brown, rarely branched. irregularly nodulose. densely fasciculate, erumpent conidiophores, 30 to 280 by 4 to 13 μ. The dark olive to chocolate-brown, mostly cylindrical conidia. borne acrogenously, are provided with one to five (usually three) septa and measure 19 to 59 by 9 to 14 (average 40 by 12) μ. The pathogen of Cactaceae in Italy described by Bongini in 1932 as *H. cactacearum* [*R.A.M.*, 12, p. 27] is thought to have been undoubtedly identical with *H. cactivorum*.

New hosts of the fungus observed in the present studies include *Cereus peruvianus*, *Cephalocereus tetetzo*, *C. collinsii*, *C. sartorianus*. *C. mezcalaensis*. *Lophocereus schottii*, *L. gatesii*, *Mammillaria hahniana*, *Espostoa lanata*. *Selenicereus* sp., *Lemaireocereus martinezi*, *L. dumortiei*, *Astrophytum ornatum*. and *Ferocactus* sp.

Effective control has been accomplished by 10-day to fortnightly applications of 2 to 4 lb. captan per 100 gals. plus 6 fl. oz. Du Pont spreader-sticker. supplemented by the eradication of diseased plants and soil sterilization with steam or chemicals.

Shanks (J. B.) & Keller (J. R.). **Low pH joins sanitation measures in fight on Poinsettia root rot.**—Reprinted from *Flor. Exch. hort. Trade World*. 1 p.. 5 figs., 1954.

At the Department of Horticulture, University of Maryland, poinsettia [*Euphorbia pulcherrima*] root rot, due chiefly to *Thielaviopsis basicola* [*R.A.M.*, 33. p. 722]. was most injurious to potted plants grown in infected soil under conditions of heavy watering and low temperatures (50° F.). Strains of the fungus from poinsettia failed to infect tobacco and vice versa. Excellent control of the root rot was obtained in acid soil (pH 4·8). while plants at pH 6·3 and 7·3 were completely defoliated and their roots rotted. Soil drenches of captan (1 oz. in 2 gals. water) checked root damage but this treatment is not recommended as a substitute for good cultural practices and soil sterilization.

Ekstrand (H.). **Övervintringen av höstsädda grödar och vallar vintern 1953–54.** [Overwintering of autumn-sown crops and forage grasses in the winter of 1953–54.]—*Växtskyddsnotiser. Stockh., 1955*. 3, pp. 50–55. 1955.

Full particulars are given of the local distribution and relative importance in

different parts of Sweden in 1953–4 of snow mould (*Fusarium*) [*Calonectria nivalis*: *R.A.M.*, 34, p. 634], *Typhula borealis* [loc. cit.], *T. itoana* [loc. cit.], and *Sclerotinia borealis* [loc. cit.] on cereals and forage grasses, and of *S. trifoliorum* on clover.

Ekstrand (H.). **Förekomsten av utvintringssvampar i utomskandinaviska länder.** [Occurrence of winter-killing fungi in extra-Scandinavian countries.]—*Växtskyddsnotiser, Stockh.*, *1955*, 3, pp. 55–56, 1955.

Apart from *Calonectria graminicola* [*C. nivalis*: see above, p. 154], *Typhula itoana* is the most widely distributed of the winter-killing fungi [see preceding abstract] encountered outside Scandinavia, extending from central Europe to the Alps and causing heavy damage in the latter region to autumn-sown cereals and forage grasses. In 1954 the author received from Dr. Constance Bowerman, of the Canadian Department of Agriculture, two specimens of *Agrostis* from the Central Experimental Farm, Ottawa, one of which was infected by *T. itoana* and the other by *T. borealis*. The latter species is known to occur in Finland right up to the Russian frontier, and its presence in the U.S.S.R. is strongly suspected. A fungus probably identical with *Sclerotinia borealis* [*R.A.M.*, 34, p. 635] has also been observed recently in Canada. The same species occurs in both the European and Asiatic zones of the U.S.S.R., where it is known as *S. graminearum* [27, p. 227].

Roberts (D. A.), Sherwood (R. T.), Fezer (K. D.), & Ramamurthi (C. S.). **Diseases of forage crops in New York, 1954.**—*Plant Dis. Reptr*, 39, 4, pp. 316–317, 1955. [Multilithed.]

The 1954 survey of 90 meadows and pastures in New York [cf. *R.A.M.*, 33, p. 426] showed that root rots, caused by various [unspecified] fungi, and *Pseudopeziza* leaf spot (*P. trifolii*) [33, p. 676] were the most serious diseases of clovers. *Stemphylium* leaf spot (*S. loti*) of birdsfoot trefoil [*Lotus corniculatus*], eyespot (*Heterosporium phlei*) of timothy [*Phleum pratense*], brown spot (*Pyrenophora bromi*) of brome grass [*Bromus* sp.], and purple leaf spot (*Stagonospora maculata*) of orchard grass [*Dactylis glomerata*: 33, p. 427] were more destructive than in the previous two seasons.

Elliott (E. S.). **Forage plant diseases observed in West Virginia during 1954.**—*Plant Dis. Reptr*, 39, 4, pp. 318–321, 1955. [Multilithed.]

This is an annotated list of forage crop diseases identified in West Virginia in 1954 which were not included in the previous list [*R.A.M.*, 33, p. 676]. Changes in the severity or distribution of certain diseases reported in 1953 are also indicated.

Vaughn (J. R.). **National turf fungicide trials 1952.**—*Golf Course Reptr*, 21, 3, pp. 18–24, 1953. [Abs. in *Biol. Abstr.*, 28, 1, p. 213, 1954.]

In turf fungicide trials carried out in 1952 [in the United States: cf. *R.A.M.*, 32, p. 131] *Sclerotinia homoeocarpa* [32, p. 629] was controlled by most of the chemicals tested, brown patch [*Corticium solani*: loc. cit.] by the mercury compounds crag, scutl, and tersan, melting-out (*Helminthosporium* [*vagans*: loc. cit.]) by actidione (ferrated), and snow mould [*Calonectria nivalis*: 31, p. 330] by mercury compounds. Copper spot [*Gloeocercospora sorghi*: 32, p. 629] responded to calocure, calochlor, calochlor plus tersan 75, PMAS, crag 531, and cadminate, all at 2 to 3 oz. per 1,000 sq. ft., and to vancide and puraturf at 1 and 0·1 pints [? respectively]. Red thread (*Corticium* [*fuciforme*: 31, p. 330]) responded to crag, puraturf coppry, tersan, and malachite green-Bordeaux mixture. In California *S. homoeocarpa* is less prevalent when a high level of nitrogen is applied, regardless of the fungicide used.

Schwinghamer (E. A.). **A form of crown rust occurring on Agropyron spp. in North Dakota.**—*Plant Dis. Reptr*, 39, 4, pp. 322–324, 1 fig., 1955. [Multilithed.]

The crown rust pathogen, observed in 1953 and 1954 on *Agropyron* spp. in eastern North Dakota and in western Minnesota, was similar to *Puccinia coronata* f. sp. *secalis* [*R.A.M.*, 33, p. 669] in host range (determined by inoculation experiments), infection types, and teleutospore morphology but differed in the lighter colour of the uredospores. The virulence of the isolates from the two States to *Agropyron* spp. suggests possible synonymy with *P. c.* f. sp. *agropyri* (*Ark. Bot.*, 8, pp. 1–26, 1909).

Tiffany (L. H.). **Fungus leaf spots of Brome Grass in Iowa.**—*Iowa St. Coll. J. Sci.*, 30, 1, pp. 21–32, 23 figs., 1955.

The following commonly prevalent fungi were isolated during 1953 and 1954 from leaf spots on brome grasses in Iowa, mostly from *Bromus inermis*, the most widely planted grass in the State: *Pyrenophora bromi* [*R.A.M.* 34, p. 302], *Rhynchosporium secalis*, *Selenophoma bromigena* [34, p. 373], *Stagonospora bromi*, *Septoria bromi*, *Hendersonia crastophila* [34, p. 789], *Ascochyta sorghi*, and *Colletotrichum destructivum*. Annotated descriptions and the results of inoculation experiments are given.

Jones (W.). **Downy mildew of Dactylis glomerata caused by Sclerophthora cryophila.**—*Canad. J. Bot.*, 33, 4, pp. 350–354, 1 pl., 1955.

In June, 1948, a downy mildew of *Dactylis glomerata* was observed for the first time in strain test rows at Saanichton, British Columbia. Light brown, oval-elongate to irregular areas and interveinal and marginal streaks occurred on the leaves, the inflorescences being occasionally infected. Diseased leaves contained *Sclerospora*-like organs of fusion within the mesophyll, while the sporangia on the ventral surface were of the *Phytophthora* type. It is considered that the disease is caused by an undescribed species of the genus *Sclerophthora* [*R.A.M.*, 32, p. 631], designated *S. cryophila* n. sp. The sporangia are 22·5 to 45·5 (average 30·5 to 38) by 11·5 to 22·5 (15 to 19) μ, with persistent pedicels, and the spherical oospores 20 to 37·5 (31·8) μ in diameter, within oogonia averaging 38·5 μ. Abundant sporangia were found on infected leaves in August, 1950, when the temperature range was 49° to 66° F., and in February, 1954, at 39·5° to 46°. Under experimental conditions the minimum, optimum, and maximum temperatures for zoospore liberation were approximately 1°, 4 to 9°, and 21° C., respectively.

The disease was found in the Fraser Valley in 1954 and is probably widely distributed. Early-growing strains of the grass may be significantly reduced in yield since *S. cryophila* can attack during the winter. Infection may be prevented by the use of disease-free seed, and reduced by the application of suitable fungicides in late autumn and again at the end of the winter.

Neill (J. C.) & Armstrong (C. S.). **An aerial survey of ascospore distribution of blind-seed disease of Ryegrass (Gloeotinia (Phialea) temulenta).**—*N.Z.J. Sci. Tech.*, Sect. A, 37, 2, pp. 106–109, 1 fig., 1 graph, 1955.

A three-year survey was carried out by the Grasslands Division, Palmerston North, New Zealand, to determine the aerial distribution and period of discharge of ascospores of *Phialea temulenta*, the blind-seed pathogen of rye grass [*Lolium* spp.: *R.A.M.*, 33, pp. 606, 759]. The aeroscope used for sampling consisted of an air pump calibrated to draw a measured volume of air through a tube, the perforated base of which was immersed in sterile water in an outer tube. Aliquots of the water were spread on Czapek-Dox agar in which sugar was replaced by yeast extract to restrict the growth of most air-borne fungi and bacteria. The characteristic germination of *Phialea* ascospores, the primary germ-tubes growing from each

end for an appreciable distance before developing lateral branches, facilitated their identification.

The fungus was recorded in the centre of Palmerston North city, at least a mile from any rye grass area. The peak period of the ascospore discharge (5th November to 5th December) coincided closely with the flowering of perennial rye grass [*L. perenne*]. The later-flowering Italian [*L. multiflorum*] and hybrid rye grasses rarely become heavily infected in the field.

Fischer (H.). **Ungewöhnliche Berostungen und Rißbildungen bei Boskoop, Glockenapfel und anderen Apfelsorten, eine Viruskrankheit?** [Is the unusual russeting and cracking on Boskoop, Glocken, and other Apple varieties a virus disease?]—*Schweiz. Z. Obst- u. Weinb.*, 64, 7, pp. 125–131, 4 figs., 1955.

Russeting and cracking on apples examined at the Federal Experiment Station, Wädenswil, Switzerland [cf. *R.A.M.*, 34, p. 374], could not be attributed to a living organism. Questionnaires to 39 growers with about 200 affected trees indicated that the percentage of damaged apples was 50 to 100 in a year of satisfactory harvest. No clear picture could be obtained regarding the distribution of damaged apples on the trees, though there seemed to be a slight tendency for greater frequency in shade than in the sun. The skin lesions were already present in June or July; damage was confined to individual trees, often surrounded by trees bearing healthy fruit. Sprays and fertilizers were excluded as possible causes.

It is presumed that a virus is involved, a view supported by the transmission of the disease from infected rootstock to healthy scions, though no evidence of transmission from scion to stock has so far been obtained. In conclusion reports on similar damage in other countries are reviewed.

Andrén (F.). **Besprutningsförsök mot Äppleskorv 1954.** [Spraying experiments against Apple scab 1954.]—*Växtskyddsnotiser, Stockh., 1955*, 1, pp. 14–17, 1955.

In 1954 experiments on the control of apple scab [*Venturia inaequalis*] were carried out in two localities of Sweden [cf. *R.A.M.*, 33, p. 539] on the Alexander and Oranie varieties, with generally favourable results. Among the fungicides applied throughout the season from 27th April to 24th August, captan at 0·25 per cent. up to 23rd June and at 0·15 per cent. thereafter was the most effective, reducing the incidence of infection in the two varieties from 37·8 and 15·5 to 0 and 0·5 per cent., respectively. Crag 361 at 0·35 per cent. and germisan, initially at 0·2 and later at 0·1 per cent., also reached a high level of efficiency, with 1·1 and 1·2 per cent. infection, respectively, on Alexander and 0·7 and 1 on Oranie. Bordeaux mixture combined with lime-sulphur was the only phytotoxic compound, causing heavy damage on both leaves and fruit; at the same time it was highly efficacious in the elimination of infection, none developing on Alexander and only 0·5 per cent. on Oranie. Satisfactory protection against ascospore infection is afforded by Bordeaux mixture or copper oxychloride, while some of the commercial copper-free preparations may be used against the conidia.

Gaudineau (Marguerite), Lafon (R.), Messiaen (C. M.), & Simone (J.). **Tavelure du Pommier. Efficacité et toxicité de divers fongicides.** [Apple scab. Efficiency and toxicity of various fungicides.]—Reprinted from *Arboricult. fruit. 1954*, 2, 6 pp., 5 figs., 1954.

Experiments on the control of apple scab [*Venturia inaequalis*] and the phytotoxicity of the various materials used were conducted at Château Brown and Moka in south-west France [*R.A.M.*, 33, p. 707] from 1949 to 1953. The earlier experiments having demonstrated the efficiency of a pre-floral application of 1 per cent. Bordeaux mixture, those in 1953 were directed towards the use at this stage

of 0·3 per cent. captan and 0·2 per cent. dichlone and of various other materials including 0·3 per cent. zineb, ferbam, and ziram, and 1 and 1·5 per cent. wettable sulphur, all as post-floral sprays. The toxicity of the copper materials became evident during May, when scab also developed. As in 1952 Bordeaux, captan, and dichlone were equally effective whether applied throughout from the pre-floral stage or just as post-floral treatments, with Bordeaux only before flowering; 0·3 per cent. ferbam and 1 per cent. micronized wettable sulphur (80 per cent. sulphur) gave almost as good a degree of control. The percentages of scabbed fruit in the following post-floral treatments at the above rates with a 1 per cent. Bordeaux pre-floral spray were Bordeaux 12·97, dichlone 14·69, captan 15·68, ferbam 19·05, and micronized sulphur 22·86.

Leben (C.), Boone (D. M.), & Keitt (G. W.). **Venturia inaequalis (Cke.) Wint. IX. Search for mutants resistant to fungicides.**—*Phytopathology*, 45, 9, pp. 467–472, 1 fig., 1955.

At the Department of Plant Pathology, University of Wisconsin, conidia of wild-type line 365–4 of *Venturia inaequalis* [*R.A.M.*, 34, p. 231] were irradiated with ultra-violet light at 2,700 to 2,800 Å for 22·5 minutes and plated on potato dextrose agar in test-tubes or Petri dishes containing 20 times the concentration of sulphur, thiram, antimycin A, or helixin B [34, p. 447] requisite for the inhibition of this and three other wild-type lines (D 5, 1031–4, and 1096).

No resistant variants developed in the cultures containing sulphur, thiram, or helixin B, but one, designated 3164, grew in the presence of antimycin A and in subsequent tests withstood 5,000 times the concentration necessary for the inhibition of the wild-type lines. It was mated *in vitro* with wild-type line 1096 and the ascospores of 44 resultant asci were isolated and cultured separately. On a control medium four spores of each of 10 asci gave rise to slow-growing cultures like 3164, while the other four produced larger ones of the wild type. The growth of the former was not suppressed on a medium containing antimycin A, on which the latter were unable to develop.

It is concluded that in 3164 the slow growth rate and resistance to antimycin A resulted from a single-gene mutation. This line and a number of its descendants carrying the resistance gene were tested on potted McIntosh apple trees and found to be non-pathogenic. Germinating conidia and sporelings of the wild-type lines were more readily inhibited by the antibiotic than were older hyphae.

Grewal (J. S.). **Effect of nitrogen nutrition on growth and sporulation of Alternaria tenuis strain B causing core rot of Apples.**—*Lloydia*, 18, 2, pp. 74–81, 1955.

The strain of *Alternaria tenuis* under consideration was isolated from core rot of apples and designated as strain B, differing from a previously studied strain from wheat (*J. Indian bot. Soc.*, 30, pp. 108–112, 1951) [*R.A.M.*, 31, p. 55; 33, p. 82]. The effect of 28 nitrogen compounds on its growth and sporulation was examined [cf. 30, p. 185]. Growth was significantly improved by magnesium and calcium nitrates, ammonium acetate and oxalate, peptone, D-alanine, L-phenyl-alanine, glycine, and acetamide, while many ammonium salts, L-leucine, and histidine were poor sources of nitrogen; there was no growth when nitrogen was omitted from the nutrient medium nor with sodium or potassium nitrite.

Sporulation was best with peptone, L-aspartic acid and all nitrates (except ammonium), fair with valine, L-asparagine, and urea; and reduced with ammonium salts in general, being checked completely by ammonium chloride, bromide, and sulphate, D-alanine, L-phenyl-alanine, glycine, acetamide, glutamic acid, methionine, L-leucine, histidine, and thiourea. Sporulation and the amount of growth were not correlated.

Refatti (E.) & Ciferri (R.). **La virosi del tipo 'scopazzi' in vivai di Melo.** [The virosis of the 'witches' broom' type in Apple nurseries.]—*Ann. Sper. agr.* N.S., 8, 5, pp. 1543–1556, 1 pl., 1 fig., 1954. [English summary.]

In the summer of 1951 one-year-old apple maidens in a nursery at Adige, Trento Italy, developed formations resembling witches' brooms [*R.A.M.*, 34, p. 792] associated with an early development of dormant axillary buds. The vigour of the affected plants, as estimated mainly by measurement of the diameter of the main stem above the graft, was usually less than that of normal maidens. The number of secondary branches formed ranged from 7 to 30 or more. The leaves were mostly small, narrow, and rather pale green, though the stipules were larger than normal. The roots were healthy. The condition was also present in Nalles Bolzano, and was reported from other localities in the Trentino-Alto Adige area. In two nurseries examined the disease was noted on the Champagne Pippin Canada Pippin, Morgenduft, and Golden Delicious varieties and, very occasionally on Jonathan. At Adige 10 per cent. of the Canada Pippin seedlings were affected the figure for Champagne Pippin was nearly as high, but for the other varieties much lower. At Nalles the variety most commonly affected was Morgenduft, with 29 diseased plants among 660, or 4·4 per cent.

In both nurseries the stocks had been obtained from Italian sources, reported as apparently healthy. The distribution of the disease was irregular; sometimes infected plants occurred singly, but more often in groups of two, three, or, exceptionally, four or five together in a row.

In experiments over two years the condition was transmitted to a healthy bud from an affected scion, but not vice versa. The disease is probably identical with that reported from Holland and Switzerland [34, p. 598] and with a similar condition found only on adult trees in Verona.

The evidence that the disease is caused by a virus is regarded as considerable but not yet conclusive. Observations of maidens grafted in 1951 indicate that the disease is transmitted from an affected tree to neighbouring ones, perhaps by root contact. The increased incidence in one plantation from 1952 to 1953 was 2·2 per cent.

Fritzsche (R.). **Über die Korkkrankheit an Glockenäpfeln.** [On the cork disease of Glocken Apples.]—*Schweiz. Z. Obst- u. Weinb.*, 64, 11, pp. 193–198, 1 fig. 1955.

In recent years the internal cork disease of apples, particularly the variety Glocken, due to boron deficiency has caused storage losses amounting to 70 per cent. in Switzerland [*R.A.M.*, 30, pp. 327, 475]. Drought and excessive rainfall favoured the disorder, the latter by dissolving the lime in the soil and fixing the boron. In 1954 the disorder affected apple trees on alkaline soils between Romanshorn and Kreuzlingen on Lake Constance, where the disease had not been observed before.

Beside other boron treatments [loc. cit.], soil applications of 500 gm. borax per 100 l. fertilizer solution proved beneficial for a stand heavily damaged by years of boron deficiency. Borax pills injected into trees through drilled holes gave good results but the process was too laborious to be practicable. The quickest method is the addition of 0·2 per cent. boric acid to a routine post-blossom spray, which without causing leaf burn, reduced the percentage of affected apples to 0 to 5 as against 16 to 63 on the untreated, but this is only an emergency measure and should be combined with boron fertilizing until the tree is able to absorb boron through the roots. Stored apples from orchards receiving boric acid showed markedly less internal cork in comparison with previous years, or with other places in the Lake Constance region.

Stoll (K.). **Einige Beobachtungen bei der Kaltlagerung von Äpfeln.** [Some observations on the cold storage of Apples.]—*Schweiz. Z. Obst- u. Weinb.*, 64, 16, pp. 295–300, 1 fig., 1 graph, 1955.

Swiss apple varieties susceptible to flesh-browning, Ontario, Champagne Pippin, Canada Pippin, and Boskoop, should be stored at 4° C.; Glocken, Berlepsch, Fraurotacher, and Damason Pippin are best stored at 0°. Scalding can be delayed and reduced by lowering the storage temperature. In storage trials at the Experiment Station, Wädenswil, Switzerland [*R.A.M.*, 33, p. 488], the very susceptible Bohn apple developed up to 98 per cent. scald at 4° with a relative humidity of 90 per cent., but storage at 0° reduced injury to one-half or one-third.

Filtration of storage gases did not effectively reduce scald, which on Boskoop and Sauergruech indicates senescent skin. A complete solution of this problem will only be found in breeding resistant varieties, and increased production of Champagne Pippin and Schweizer Orangen has begun.

Non-shrinking, susceptible varieties such as Bohn need 85 to 88 per cent. relative humidity, but most Swiss apples shrink at under 90 per cent. and weight losses through transpiration may rise to 10 to 12 per cent. as against a normal 3 to 7 for the cold-storage period.

Gloeosporium [? *album*: cf. 34, pp. 157, 653], causing the largest storage loss, spreads only in maturing fruit, the visible symptom being the coalescence of lenticel infection into large blotches. Unduly prolonged storage may also cause loss through skin-, flesh-, and core-browning, accompanied by loss of juice and aroma. Abrupt changes of temperature on removal from store may lead to a collapse of the fruit and a transition period is recommended at 7° to 8° for further ripening and improvement of colour and flavour.

Gachon (L.) & Collier (D.). **Les causes du dépérissement de la Reinette blanche du Canada en Auvergne.** [The causes of the wilting of White Canada Pippin in Auvergne.]—*C. R. Acad. Agric. Fr.*, 41, 8, pp. 395–398, 1955.

Wilting of White Canada Pippin apple trees [cf. *R.A.M.*, 34, p. 303] has occurred for years in certain districts of Auvergne, France. The syndrome resembles branch senility on an old but healthy tree and is due to deterioration of the vascular system: 25 years after planting wilting trees have a diameter of only about 8 cm., while normal trees attain at least 16; shoots are sparse and short, the sap may fail to reach the extremities, which dry out, and the trees are then cut back each year and retain only a few stumps of old wood. Leaves are small, few, and pale green, while the bark, particularly in places exposed to the sun, changes to orange-red. Fruits are numerous, small, and highly coloured, but have good keeping qualities.

The hypothesis that this deterioration is due to nitrogen deficiency [27, p. 424] has been experimentally disproved by the authors. Other experiments with manures and fertilizers and foliar analyses also gave no positive clue, but soil analyses led the authors to the conclusion that the wilting is due mainly to the dry and poorly aerated subsoils impermeable to water and impenetrable by apple roots (the usual rootstock in these districts being Noir de Monton). The roots become coralloid and the root-hair production is greatly reduced. For five or six years, while feeding mainly on the soil thrown up when they were planted, the trees retain normal vigour, but after seven to eight years of fruit-bearing they stop growing and wilt.

Woodhead (C. E.). **Seasonal fluctuation and incidence of ring spot on Granny Smith Apples.**—*N.Z.J. Agric.*, 90, 3, pp. 283, 285–286, 2 figs., 1955.

Observations from 1949 to 1953 showed that the ring spot disease of Granny Smith apples in Auckland, Hastings, and Nelson, New Zealand [*R.A.M.*, 33, p. 731], has not assumed any great economic significance. The substantial losses recorded on individual trees, however, indicate the need for careful bud selection.

Chamberlain (G. C.) & Townshend (J. L.). **An unusual occurrence of Phytophthora rot of Pears.**—*Plant Dis. Reptr*, 39, 4, pp. 312–313, 1 fig., 1955. [Multilithed.]

In the Niagara peninsula, Ontario, Canada, *Phytophthora cactorum* caused considerable damage to Kieffer pears [*R.A.M.*, 33, p. 609] held in common storage to ripen for processing. Excessive rainfall in the first part and middle of October, causing splashing and flooding of pears in containers left on the ground, was largely responsible for infection, which has not previously been of economic importance in the area.

Crosse (J. E.) & Bennett (Margery). **A selective medium for the enrichment culture of Pseudomonas mors-prunorum Wormald.**—*Trans. Brit. mycol. Soc.*, 38, 1, pp. 83–87, 1955.

A selective medium for the enrichment culture of *Pseudomonas mors-prunorum* [*R.A.M.*, 34, p. 769 and next abstract], originally developed to study the possible occurrence of small populations overwintering epiphytically on dormant buds and other surfaces of stone fruit trees, has since proved extremely valuable at East Malling Research Station for making isolations from diseased bark and leaf tissues in summer and autumn, respectively, when few viable cells of the bacterium are normally encountered in the lesions. It is composed of 10 gm. sodium tartrate, 0·1 gm. di-octyl sodium sulphosuccinate, 2 gm. sodium nitrate, 1 gm. potassium monohydrogen phosphate, 0·5 gm. each of magnesium sulphate and potassium chloride, and a trace of iron sulphate, in 1,000 ml. glass-distilled water.

There was little variation in growth on the medium among 30 strains of *P. mors-prunorum* from plum and cherry. Cherry strains C 12 R and C 13 grew best at pH 6·5. The tartrate broth proved markedly superior to sucrose broth and non-selective difco broth plus sucrose in isolations from necrotic leaf spots in the autumn of three successive years, particularly in 1952 when at pH 5·5 nine out of ten tubes showing colonies yielded *P. mors-prunorum* and seven pure cultures. In December, 1951, the surfaces of 200 Schrecken cherry buds were smeared with slime of the bacterium and exposed to normal winter weather until April, when they were removed to tubes of tartrate broth. Nine yielded pure cultures of *P. mors-prunorum* and the remaining tubes were growth-free.

Crosse (J. E.). **Bacterial canker of stone-fruits. I. Field observations on the avenues of autumnal infection of Cherry.**—*J. hort. Sci.*, 30, 2, pp. 131–142, 2 pl., 1 fig., 1 graph, 1955.

Field examinations, made over four years, of natural cankers on cherry trees (varieties Napoleon, Roundel, and Waterloo) caused by *Pseudomonas mors-prunorum* [see preceding abstract] and *P. syringae* [*R.A.M.*, 34, p. 769] at East Malling Research Station, Kent, showed that they were associated with wounds, fruiting spurs, and nodes on one-year-old wood. Evidence was found of spur and node infection through leaf scars. Most branch cankers, and also 'die-back' on Napoleon and Roundel, arose from leaf scar infection of fruiting spurs. There was no consistent relationship in the annual and varietal distribution of diseased spurs and nodes. Partially diseased spurs and nodes where the buds remain healthy have not hitherto been recorded in Britain. This phenomenon may explain why nursery stocks sometimes succumb to the disease after transplanting in areas remote from sources of infection.

The incidence of diseased spurs varied widely with the season, but associated symptoms were fairly uniform and appeared to be characteristic mainly of the variety. On Waterloo leaf scar infection was to some extent overshadowed by the extensive 'die-back' resulting from crotch cankers. The three varieties in the observation plot behaved in accordance with previous field experience. The greater

'field resistance' of Roundel appeared to be due to greater resistance of the tissues to the spread of infection and lower initial susceptibility.

Woodbridge (C. G.). **The boron requirements of stone fruit trees.**—*Canad. J. agric. Sci.*, 35, 3, pp. 282–286, 4 pl., 1955.

At the Canada Department of Agriculture, Summerland, British Columbia, boron deficiency on peach [*R.A.M.*, 29, p. 265], apricot [30, p. 75], prune, and cherry [cf. 31, p. 223] trees grown in sand culture was characterized by a spring die-back of the branches, while the toxicity symptoms varied considerably [21, p. 26]. On peach, brown, necrotic marks on the underside of the midrib were most typical; on apricot, swelling of the nodes; on prune, cracking and sloughing off of the bark on two-year-old twigs; and on cherry, die-back of terminals accompanied by gumming. A close relationship was noted between the boron content of leaf and twig tissues and symptom expression.

Novaković (V.). **Rezultat pregleda terena radi utvrđivanja šarke Šljive u N R B i H u 1954 god.** [Results of field investigations for determining Plum pox disease in N.R.B. and H. in 1954.]—*Zasht. Bilja* (*Plant Prot., Beograd*), *1955*, 28, pp. 107–112, 1 pl. (opposite p. 113), 1 map, 1955. [German summary.]

A survey for plum pox disease [*R.A.M.*, 35, p. 107] carried out in Bosnia and Hercegovina [34, p. 463], Yugoslavia, in 1954, showed that the infection was highest in central Bosnia, reaching 75 per cent. in some areas. Severe infection was also noticed in isolated areas near Doboj, Bijeljina, Zvornik, Srebrenica, Višegrad, Bihać, Cazin, and Bosanski Petrovac.

Oak-like mosaic (line pattern) [peach line-pattern virosis virus: cf. 34, p. 347], prevalent in most of the areas inspected, was particularly severe on white plums (50 per cent. infection) and less so on Požegača (10 per cent.) in the Bosanski Šamac and Modriča districts.

Koch (L. W.). **The Peach replant problem in Ontario. 1. Symptomatology and distribution.**—*Canad. J. Bot.*, 33, 5, pp. 450–460, 1955.

For many years difficulty has been experienced in establishing young peach trees in old orchard sites in south-western Ontario [*R.A.M.*, 35, p. 27 and next abstract]. Affected trees show retarded growth, stunting, and interveinal chlorosis, and discoloration and necrosis of the roots. The author reviews reports of similar problems, including poor growth of mazzard cherry [*Prunus avium*], myrobalan plum [*P. cerasifera*], French pear, and mahaleb cherry [*P mahaleb*] following peaches in Ontario (*Sci. Agric.* 16, pp. 16–20, 1935). In recent studies on an allied problem in Georgia [*R.A.M.*, 33, p. 434], *Clitocybe* [*tabescens*] root rot was found to be a major cause of losses of peach replants, and citrus slow decline in California [28, p. 62] would appear to be of like nature.

Patrick (Z. A.). **The Peach replant problem in Ontario. II. Toxic substances from microbial decomposition products of Peach root residues.**—*Canad. J. Bot.*, 33, 5, pp. 461–486, 1 pl., 3 graphs, 1955.

In a further contribution to this series [see preceding abstract] from the Science Service Laboratory, Harrow, Ontario, substances which inhibited the respiration of excised peach root tips were produced when either peach root residues or pure amygdalin were acted upon by soil micro-organisms from an old peach orchard. It is concluded that the toxic factor frequently found in old peach orchard soils is produced by the microbial decomposition of the amygdalin in old peach roots.

Kenworthy (A. L.), Bell (H. K.), & Larsen (R. P.). **Zinc deficiency found in Michigan Peach orchard.**—*Quart. Bull. Mich. agric. Exp. Sta.*, 38, 1, pp. 70–72, 1 fig., 1 diag., 1955.

The presence of zinc deficiency has been confirmed in a peach orchard near

Riverside, Michigan [*R.A.M.*, 34, p. 603]. This is the first record for any of the Central United States between the Alleghany and Rocky Mountains.

Govi (G.) & Tassinari (M. M.). **Phytophthora megasperma Drech. agente di marciume radicale del Pesco.** [*Phytophthora megasperma* Drech., the cause of root rot of Peach.]—*Ann. Sper. agr.*, N.S., 8, 4, pp. 1187–1196, 2 pl., 6 figs., 2 graphs, 1954. [English summary.]

Peach trees growing in the Romagna region of Italy have, since 1950, been affected by a rapid and fatal decline in the form of a root rot, which in 1950 (a very wet year) killed almost entire blocks of trees in a few weeks, though in 1951 and 1952 only a few trees were attacked and no further spread occurred. The first symptoms appear towards the end of spring, when the leaves turn yellow and fall, the branches being almost completely defoliated, though a few may retain their leaves for a period. Gum is exuded from the collar, and the cortical and woody tissues of the trunk and root are coloured brown. Isolations from affected material yielded a strain of *Phytophthora megasperma* [C.M.I. map No. 157].

Inoculations of four two-year-old potted wild peach plants, made by inserting a fragment of mycelium in the trunk 30 cm. above the soil surface and also beneath the collar, gave positive results on one plant only, which developed signs of disease 27 days after inoculation. Intense blackening of the cortical and woody tissues developed at the site of inoculation in the region opposite the wound. Cultures from the affected areas gave an unidentified species of *Phytophthora*. Apple fruits were infected but not potato tubers. *P. megasperma* does not appear to have been recorded in Italy before.

Mirzabekyan (R. O.). Антибиотики как средство для оббеззараживания черенков от внутренней инфекции. [Antibiotics as a means of disinfecting scions against internal infection.]—Агробиология [*Agrobiology, Moscow*], *1955*, 2, pp. 130–134, 2 figs., 1955.

At the Institute of Genetics, U.S.S.R. Academy of Sciences, apricot scions affected internally by bacterial wilt (*Bact*[*erium*] *armeniaca*) [*R.A.M.*, 32, pp. 132, 636] were immersed in grizemin (an antibiotic preparation obtained from the Institute of Epidemiology and Microbiology, U.S.S.R. Academy of Medical Sciences) and streptomycin, both at 1 in 1,000, for 24 to 48 hours. None exhibited symptoms when grafted on to suitable stocks. Of 100 'eyes' [buds] steeped in grizemin and 100 in streptomycin for 24 hours, 83 and 89, respectively, were surrounded by a sterile zone when plated on seeded meat peptone agar, compared with none of similar pieces immersed in sterile water. Similarly, of 11 scions immersed in streptomycin and 12 in grizemin for 24 hours, rinsed under tap water for 2 to 3 minutes, and plated on seeded meat peptone agar, nine of each, as against one out of 10 in the control, were sterile and did not allow the growth of *B. armeniaca* colonies.

Welsh (M. F.). **Little cherry, its nature, importance, and possible means of control.** —*Commonw. phytopath. News*, 1, 3, pp. 36–37, 1955.

The author here surveys the present position regarding the little cherry virus disease of cherry in British Columbia [*R.A.M.*, 33, p. 708] with particular reference to the symptoms and characteristics.

Ogawa (J. M.), Nichols (C. W.), & English (H.). **Almond scab.**—*Bull. Calif. Dep. Agric.*, 44, 2, pp. 59–62, 3 figs. (1 col.), 1955.

Almond scab (*Cladosporium* [*Fusicladium*] *carpophilum*) [*R.A.M.*, 30, p. 216], first reported in California in 1924, has caused considerable losses in recent years. The symptoms on young shoots are water-soaked areas which later turn brown;

on the fruit circular, olivaceous spots enlarge and may coalesce; the principal damage, however, is to the leaves, on which coalescent infected areas, finally turning brownish-black, cause premature defoliation. High humidity seems to favour the disease.

A survey of almond orchards in Sacramento Valley in 1954 showed the disease to be present in eight counties, affecting the varieties Drake, I.X.L., Nonpareil, Peerless, Ne Plus Ultra, and 'Smith I.X.L.' The last two and to a lesser degree Drake were most severely affected, while Jordanolo usually suffered less damage than other varieties.

The exact identity of the fungus is questioned, since other stone fruits usually attacked by *F. carpophilum* and adjacent to scab-infected almond trees showed no signs of infection.

CORKE (A. T. K.). **Blackcurrant leaf spot : II. Laboratory tests of fungicides for the prevention of sporing of Pseudopeziza ribis on overwintered leaves.**—*J. hort. Sci.*, 30, 3, pp. 197–200, 1955.

Further fungicide trials were carried out at Long Ashton Research Station, Bristol, for preventing the maturation of *Pseudopeziza ribis* ascospores on overwintered black currant leaves [*R.A.M.*, 34, p. 604] and thus reducing the spring inoculum. In January, 1954, batches of 25 infected leaves gathered the previous November were immersed for five seconds in various fungicidal concentrations, left to dry for two hours, placed outside under cover for two days, and then left fully exposed until the end of May. The fungicidal effect was assessed by the power of the fungus to discharge ascospores in the spring. Aqueous solutions of sodium-DNC and sodium pentachlorophenate effectively prevented this at 0·1 per cent., phenyl mercury chloride at 0·05 per cent., and triethyl tin hydroxide at 0·2 per cent. Cetylpyridinium bromide was of little value.

Comparison between these laboratory findings and the 1953 field trials [loc. cit.] showed the efficacy of immersion of diseased leaves, as opposed to spraying them on the ground where satisfactory wetting cannot be achieved. The effect of applying fungicide before leaf fall is now to be investigated, together with its possible phytotoxic effect.

STACE-SMITH (R.). **Studies on Rubus virus diseases in British Columbia. I. Rubus yellow-net. II. Black Raspberry necrosis.**—*Canad. J. Bot.* 33, 3, pp. 269–274, 1 pl.; 4, pp. 314–322, 1 pl., 1955.

A clone of Himalaya blackberry (*Rubus procerus*) growing at Abbotsford, British Columbia, bore foliage markings suggestive of a virus infection: indistinct chlorosis along the veins of young leaves turned yellow with maturity and spread outwards towards the margin until in the autumn the leaves became cup-shaped owing to cessation of growth in the chlorotic areas. The plants continued to yield well and there was no apparent stunting. The virus nature of the disease, named *Rubus* yellow-net, was established by graft transmissions, using Cadman's method [*R.A.M.*, 31, p. 439], to Washington red raspberry (*R. strigosus*) which developed a pale, net-like chlorosis and slight leaf cupping in the year following grafting. The virus was also transmitted from *R. strigosus* to tropical black raspberry (*R. albescens*) and North American black raspberry (*R. occidentalis*) by *Amphorophora rubi*, which became infective after one hour's feeding, and remained so for less than four hours.

In the second contribution a virus latent in some commercial red raspberry varieties in British Columbia, and producing severe symptoms on *R. occidentalis*, is described and named black raspberry necrosis virus. Wilting of the tip of the black raspberry cane occurred five to seven days after inoculation with the aphid *A. rubi*, previously fed on infected, detached, red raspberry leaves. Small, necrotic

flecks appeared along the petiole, midrib, and secondary veins on young unfolding leaves and on the wilted parts of the older ones. Eventually the flecks enlarged and coalesced forming black, necrotic areas, the rest of the mature leaf developing a yellow-green mottle. After two weeks the cane tip died back for several inches. Following graft inoculation, symptom appearance was delayed by 16 to 20 days.

The virus was acquired by *A. rubi* after a half-hour feed and transmitted after two minutes on a susceptible host. The ability to transmit was generally lost within one and a half hours.

Red raspberry varieties carrying the virus without visible symptoms include Newburgh, Latham, St. Regis, Malling Enterprise, Malling Promise, Seedling G, and Norfolk Giant. A very mild mottling was exhibited by Taylor and Washington.

It is concluded that black raspberry necrosis corresponds to Bennett's severe red raspberry mosaic [12, p. 770] and has a number of features in common with Cadman's raspberry leaf mottle [33, p. 736].

Wilhelm (S.). **Verticillium wilt resistance.**—*Calif. Agric.*, 9, 9, pp. 8, 15, 1 fig., 1 graph., 1955.

Some of the information in this paper on strawberry wilt caused by *Verticillium* [*albo-atrum*] has already been noticed [*R.A.M.*, 35, p. 30]. *Fragaria chiloensis* shows a graded resistance similar to that of cultivated varieties, individual plants from near Bodega Bay, California, being highly resistant. Most of the resistant strawberries obtained in these trials had glossy, dark green leaves, and 95 per cent. were equally resistant to powdery mildew [*Sphaerotheca humuli*: loc. cit.], though not all mildew resistant seedlings proved resistant also to *Verticillium*.

Hill (R. G.) & Gould (W. A.). **Strawberries evaluated on the basis of 1953–4 Station plantings.**—*Fm Home Res.*, 40, 293, pp. 20–21, 31, 2 figs., 1955.

Strawberry variety trials at Ohio Agricultural Experiment Station, Wooster, in 1954 were confined to varieties bearing in June. The resistance to red stele [red core: *Phytophthora fragariae*: *R.A.M.*, 34, p. 305 and above, p. 159] of the varieties Fairland, Red Crop, Sparkle, and Vermilion, recommended for growing in Ohio, [loc. cit.], was confirmed. A new introduction, Stelemaster, proved resistant to more than one strain of *P. fragariae*; such resistance is not at present required in Ohio, and owing to inadequate commercial qualities the variety is not recommended for growing in the State.

Virus-free plants of Catskill, Premier, and Sparkle produced, respectively, 3·7, 10, and 7 more runner plants than those infected by virus [unspecified], fruiting was superior, and yields remarkably increased, healthy Catskill producing 9,228 quarts per acre compared with 5,317 from commercial plants, the corresponding figures for Premier being 6,636 and 4,043, and for Sparkle 4,920 and 3,010. Virus-free plants of most varieties grown in Ohio are available.

Ebeling (W.). **Causes of Avocado leaf injury.**—*Calif. Agric.*, 9, 8, pp. 9–10, 3 figs., 1955.

A necrotic injury to avocado leaves in California, hitherto attributed to insect damage, is apparently the result of an as yet undetermined physiological disorder. The damage is less serious than that caused by insects, but more widely distributed throughout southern California, and usually more abundant. On young unfolding leaves centripetal necrosis makes the leaves look as if eaten from the margin towards the midrib, while the margins develop a narrow, yellowish border. In mature leaves small, necrotic areas appear in the centre and finally drop out. The disease may destroy 25 to 50 per cent. of the surface of leaves in the interior of the tree.

Purss (G. S.). **Identification of the species of Fusarium causing wilt in Passion Vines in Queensland.**—*Qd J. agric. Sci.*, 11, 2, pp. 79–81, 1954.

Cross-inoculation studies with various forms of *Fusarium oxysporum* commonly occurring on passion fruit, pea, watermelon, and tomato in Queensland showed that these are all distinct forms and that *F. o.* f. *passiflora* n.f. is responsible for the wilt of passion fruit [*R.A.M.*, 32, p. 575].

Mukoo (H.). **Studies on the causal bacteria of the Loquat canker II. On the vitality of Bac. eriobotryae exposed to light.**—*Bull. nat. Inst. agric. Sci.*, Ser. C, 2, pp. 49–133, 1953. [Japanese, with English summary.]

When *Bacterium* [*Pseudomonas*] *eriobotryae*, the cause of loquat canker, is exposed to sunlight, death is more rapid in the dry state than in the wet. The age of the culture does not affect resistance to sunlight, but the greater the number of bacteria exposed the higher their resistance. A sheet of white paper lengthens the period of viability in sunlight. Summer sunlight is more lethal than winter, and the blue end of the spectrum is the most potent. The effect of sunlight varies according to the composition and pH of the medium in which the bacteria are suspended; for instance, death is more rapid in a sodium chloride solution than in distilled water. The resistance of the bacteria to ultra-violet rays depends on the age of the culture, the distance from the source, the number of bacteria, and the suspending medium. *P. eriobotryae* is less resistant to ultra-violet rays than any other plant-pathogenic bacterium.

Holmes (E.). **The contribution of commerce to crop protection.**—*Ann. appl. Biol.*, 42 (*Proc. Jubilee Meeting, London, 13–17 Sept., 1954*), pp. 325–332, 1955.

The contributions made in recent years to crop protection by commercial manufacturers of fungicides and allied products are treated under the following headings: fundamental biological and chemical studies; work on new chemicals, including insecticides, fungicides, and weed-killers; work on techniques; costs of production of new chemicals; and economic benefits to agriculture.

Maurice (P.). **Methods for the control of fungi (1) & (2).**—*Chem. Prod.*, 18, 5, pp. 167–169; 6, pp. 213–215, 2 figs., 1955.

Useful information is presented on general and particular methods for the control of fungi in various industries, with a consideration of the special problems involved in the application of chemicals to different products. Reference has been made from time to time in this *Review* to most of the subjects under discussion, but the concentration ranges (in per cent. weight/volume) for fungistatic efficiency assigned to the following preservative materials may be recapitulated: creosotes 0·1 to 1; dehydroacetic acid, esters of *p*-hydroxybenzoic acid, *p*-nitrophenol, DNC, arsenic trioxide, borax, copper arsenate, copper sulphate, and sodium arsenite 0·01 to 0·1; chlorinated phenols, cresols, and xylenols, phenyl and chlorinated phenyl phenols, salicylanilide, 2, 2′-dihydroxy-5, 5′-dichlorodiphenylmethane, thiram, ziram, and copper naphthenate 0·001 to 0·01; and organic mercurials 0·0001 to 0·001.

Heller (E.) & Emmel (L.). **Taschenbuch für den Vertrieb giftiger Pflanzenschutzmittel.** [Pocket-book on the sale of poisonous plant protectives.]—147 pp., 3rd enlarged edition, Raiffeisendruckerei GmbH., Neuwied, 1955. [Review in *PflSchBer.*, 15, 1–3, pp. 33–34, 1955.]

Besides a comprehensive synopsis of the legislation concerning toxic substances, this book contains information on the classification of the commonest poisonous plant protectives, wood preservatives, and disinfectants, their properties and range of application, their dangers to human beings and animals, and descriptions of symptoms of poisoning, together with recommended precautions and first aid measures.

Cunningham (G. H.). **Certification of therapeutants. New list of approved fungicides and insecticides.**—*N.Z. Gdnr*, 12, 1, pp. 59, 61, 63, 65, 67, 69, 71, 73, 1955.

This list, the 37th, of certified therapeutants for New Zealand cancels all previous lists [cf. *R.A.M.*, 33, p. 740].

Dimond (A. E.) & Horsfall (J. G.). **Fifty years of fungicides.**—*Ann. appl. Biol.*, 42 (*Proc. Jubilee Meeting, London, 13–17 Sept., 1954*), pp. 282–287, 1 graph, 1955.

The authors discuss some major achievements of fungicides in assuring a stable food supply during the past 50 years and refer to present problems still unsolved. Past achievements dealt mainly with the protection of plant surfaces, whereas the future will be largely concerned with internal treatments and chemotherapy.

The outstanding contribution has been that of seed treatment. The development of copper and organic mercury fungicides has resulted in remarkably low costs of treatment and returns on the investment probably unparalleled in the history of plant protection.

The phytotoxic effects of Bordeaux mixture on potatoes in the United States were eliminated by the use of nabam or zineb, and between 1939 and 1952 the yield of potatoes per acre doubled. In Great Britain the phytotoxicity of Bordeaux mixture is of small consequence to the plant, owing to the wetter climate, and organic fungicides would offer fewer advantages than in the United States. The organic fungicides as a group have a lower tenacity than Bordeaux mixture, but attention to the rôle of the electrokinetic charge on fungicides in adsorption to the leaf surface may permit the development of materials with greater fungitoxicity than Bordeaux mixture, yet with its tenacity and ability to redistribute on the plant [cf. *R.A.M.*, 33, p. 741]. These factors are of importance in direct relation to the frequency of rainfall. The present organic fungicides will probably be more effective in areas of low than of high rainfall, except where they may have a high specificity for a given pathogen in a wet area. Modern laboratory assay methods have emphasized that a fungicide improves in toxicity as it can enter the cell more readily, and in a number of organic fungicides the toxophore (the fungitoxic moiety) can be distinguished from the lipophore (the fat solubilizing groups).

The outstanding problem for the future is the likelihood that strains of fungi will arise resistant to materials at present effective. Perhaps too small a proportion of the inoculum in a given site is exposed to a fungicide at one time to increase appreciably the likelihood of its developing resistance, but this should be studied now. Steps should be taken to diminish the possibility that new resistant strains are likely to arise by a search for fungicides with multiple toxic mechanisms, or by the use of two fungicides with different toxic mechanisms always in combination, or else by applying fungicides to resistant varieties of the host.

The prevention of the phytotoxic effects of Bordeaux mixture by substituting organic fungicides on the potato crop has now revealed the extent to which other diseases, notably wilts, damage this crop. The use of antibiotics is now proving effective in disease control, and chemotherapy is already promising, as in the use of calcium sulphamate to control wheat rusts.

Hammarlund (L.). **Afprøvining af plantebeskyttelsesmidler 1954.** [Evaluation of plant protectives 1954.]—*Tidsskr. Planteavl*, 59, 1, pp. 1–16, 1955. [English summary.]

The following information is presented by the Danish State Experimental and Research Station for Plant Diseases and Pests on the basis of trials conducted in 1954 [cf. *R.A.M.*, 34, p. 161]. Thiram preparations were more effective than mercurials in the control of *Phoma betae* on beet [34, p. 347] in small-scale trials.

The yield increases obtained by spraying potatoes with zineb against *Phytophthora infestans* [loc. cit.] appear to be attributable in part to the action of zinc, even where no symptoms of deficiency of the element are present. The results of experiments in which spray mixtures were applied at dosages of 500 and 1,000 l. per ha. revealed no differences in the effects on yield provided the amounts of copper or zineb were maintained at the same level throughout.

Septoria apii on celeriac [cf. next abstract] was adequately controlled by Bordeaux mixture 2–1–100 and copper oxychloride with a 50 per cent. copper content at a concentration of 0·7 per cent., the former generally giving heavier yields; the results of tests with zineb were very variable.

Four applications of captan, zineb, and Bordeaux mixture against *Albugo candida* [*Cystopus candidus*] on horse-radish [34, p. 502] resulted in increased yields, the last-named being the least efficient in this respect though the most active in eliminating the pathogen.

In a preliminary test a single application of captan substantially reduced the incidence of *Botrytis cinerea* on strawberries [33, p. 541]. This preparation is also one of the best fungicides for controlling apple scab (*Venturia inaequalis*), but it caused rather more russeting than in last year's trials [34, p. 161] and was highly phytotoxic to Soldat Laboureur pears [treated against *V. pirina*]. Captan is further effective in the control of *Gloeodes pomigena* on apple. Wettable sulphurs do not confer absolute protection against *V. inaequalis* and tend to cause severe damage to both foliage and fruit; they are, however, indispensable where apple mildew [*Podosphaera leucotricha*] is prevalent, especially near the sea, the minimum concentrations for efficiency being 0·5 and 0·33 per cent. for pre- and post-blossom sprays, respectively, with a total consumption of 3,000 l. per ha. A sprayer of the type used in conjunction with domestic vacuum-cleaners was tested in comparison with standard equipment and gave equally satisfactory results with a tenfold concentration of wettable sulphur or captan and about one-tenth of the normal quantity of liquid.

Waeffler (R[uth]), Gasser (R.), Margot (A.), & Gysin (H.). **Über organische Fungizide. Sulfonamid-Derivate.** [On organic fungicides. Sulphonamide derivatives.]—*Experientia*, 11, 7, pp. 265–266, 1955. [English summary.]

The results of preliminary laboratory, greenhouse, and field tests to determine the fungicidal efficiency of three compounds of the sulphonamide group, viz., chlorosulphan, norsulphan, and mesulphan, are reported from the Research Laboratories of J. R. Geigy AG., Basel, Switzerland, among the pathogens used being *Septoria apii* on celery [see preceding abstract], *Plasmopara viticola* on vine, *Phytophthora infestans* on potato, and *Venturia inaequalis* on apple. Mesulphan was the most promising of the three, exerting an action comparable to that of captan, Bordeaux mixture, and a copper-zineb mixture on *Plasmopara viticola*, and to captan and copper oxychloride plus ultra-sulphur on *V. inaequalis*. The effects of the sulphonamides on *Phytophthora infestans* and *S. apii* did not appear to be sufficiently lasting.

Pasty (Mme). **Action antifongique de la dibromomercurifluorescéine sur Venturia inaequalis (Cooke) Aderh. et sur Phytophthora infestans (Mont.) De Bary.** [Anti-fungal activity of dibromomercurifluorescin against *Venturia inaequalis* (Cooke) Aderh. and *Phytophthora infestans* (Mont.) de Bary.]—*Bull. Soc. mycol. Fr.*, 70, 1, pp. 63–64, 1954. [Received 1955.]

The growth in culture of *Venturia inaequalis* was completely inhibited by dibromomercurifluorescin [cf. *R.A.M.*, 31, p. 341] at dilutions of 1 in 1,000 to 1 in 5,000. Similar results were obtained with *Phytophthora infestans* though they were less well marked owing to the difficulty in securing satisfactory cultures. Combined

with a wetter and sticker the chemical was innocuous when sprayed on the various plant parts.

Wilson (J. D.). **How various formulations affect the performance of dithiocarbamate fungicides.**—*Agric. Chemic.*, 8, 5, pp. 46–48, 139, 1953.

An expanded account of this information has already been noticed from another source [*R.A.M.*, 34, p. 470].

Vogelsänger (W.). **Die Bestimmung selektiver Auswaschung von Spritzbelägen.** [The determination of selective leaching of spray deposits.]—*NachrBl. dtsch. PflSchDienst* (*Braunschweig*), *Stuttgart*, 7, 2, pp. 29–30, 2 graphs, 1955.

At the Institute of Plant Pathology, University of Göttingen, Germany, fungicides were sprayed on to glass plates and dried. Some were subjected to artificial rain equivalent to 3 or 10 mm. Copper preparations were tested by a colorimetric ammonia method. Four copper oxychlorides and two copper oxides were practically unchanged by the treatment and were thus resistant to leaching. Four unnamed organic preparations were tested before and after rain treatment by adding spores of *Alternaria solani*. Three were resistant to leaching. The fourth was reduced by half under 3 mm. rain and to 10 per cent. by 10 mm.

Kahl (E.) & Wenzl (H.). **Über die Brauchbarkeit der Oberflächenspannungsmessung zur Bestimmung der Netzfähigkeit von Spritzbrühen.** [On the usefulness of surface tension measurement for the determination of the wetting power of spray liquids.] *-PflSchBer.*, 15, 1–3, pp. 1–8, 1955. [English summary.]

Results obtained by H. Zeumer [*R.A.M.*, 33, p. 491; 34, p. 48] tally with the authors' earlier [30, p. 280] and recent experience that the surface tension data for sprays are often no reliable indicator of their wetting capacity. Although, generally speaking, there is a definite statistical relation between surface tension and wetting capacity, which usually increases with decreasing surface tension, this relation is obscured by other influences so that various liquids of similar surface tension give different wetting results on the same test plants. Hence reliable conclusions cannot be drawn except for a comparatively narrow range of very low values. Sprays with a surface tension of 23 (to 28) dyn. cm.$^{-1}$ or less proved good wetters in all tests. For others, trials on economic plants are indispensable.

Fontana (P.) & Pastorelli (Luciana). **Determinazione dell'uniformità dei depositi sui vetrini irrorati con l'apparecchiatura per la determinazione dell' attività anticrittogamica in laboratorio.** [Determination of the uniformity of the deposits on slides atomized by means of the apparatus for determining fungicidal activity in the laboratory.]—*Ann. Chim. appl., Roma*, 44, 12, pp. 982–987, 1954. [Received November, 1955.]

The fungicidal activity of various materials *in vitro* is generally estimated by means of a standard apparatus devised by McCallan and Wilcoxon [*R.A.M.*, 9, p. 730] and modified by Ciferri and Baldacci [25, p. 221]. Since one of the chief factors in the reproducibility of these tests is the uniformity of the distribution of the fungicide on the slide, this was checked by microchemical examination of the deposits of copper salts and zineb on four or five slides atomized on a rotating disk. For both fungicides the degree of uniformity was satisfactory in the same series of atomizations; on an average one reading in five was anomalous. The active principle in the zineb deposits, however, was lost within a few hours.

Brittain (R. W.), Brazee (R. D.), & Carleton (W. M.). **Evaluating dusting and spraying efficiency.**—*Agric. Engng, St. Joseph, Mich.*, 36, 5, pp. 319–320, 323, 1 fig., 1955.

From the Michigan Agricultural Experiment Station the authors describe in

detail a method for the titrimetric analysis of copper for use in evaluating deposits of copper-containing insecticides and fungicides on plant leaves [cf. *R.A.M.*, 32, p. 635]. The following is a summary of the procedure. After spraying, samples are taken by means of a punch from definite leaf areas and washed in a jar until the deposit is removed. The solution is then made neutral or slightly acid and potassium iodide added, thereby releasing free iodine, which is titrated against sodium thiosulphate, using starch as an indicator [cf. 31, p. 502].

Experiments to determine the applicability of this technique to the evaluation of chemical deposits indicated that the error in assay did not exceed 5 per cent., and the introduction of leaves, with their accompanying impurities, did not appear to impair its precision. Less error was recorded in the analysis of the solutions containing calcium hydroxide than in those free from the compound. The method further tended to be more exact in the analysis of strong than in that of weak copper solutions. In tests of concentrations of approximately 1 mg. copper in 50 ml. copper sulphate solution there was a maximum error or $\pm$0·05 mg. copper. When leaf samples were washed and aliquots of the same solution analysed both by the present technique and polarography, the two methods were in agreement to within 0·1 mg. copper for concentrations of about 1 mg. copper in 50 ml. solution.

It should be realized, however, that plants sprayed or dusted in the field may contain deposits of as little as 0·1 mg. copper or less per sq. in. leaf surface, in which case the deposits from perhaps 10 sq. in. of leaf would have to be placed in 50 ml. wash solution to produce a concentration high enough for titrimetric analysis.

Among the advantages of the new procedure are rapidity, portability, simplicity, and economy, but the method is restricted to copper-containing materials and the maximum practicable sensitivity is $\pm$0·1 mg. copper. Moreover, it gives no information as to uniformity of coverage of the leaf sample, and allowance has to be made for field impurities.

Zehner (W. H.). **Problems and materials of sprayer construction.**—*J. agric. Food Chem.*, 2, 22, pp. 1104–1106, 1 fig., 1 graph, 1954.

During the past eight years the increasing numbers and variety of chemicals used in agricultural sprays have created a demand for more versatile spraying equipment. The principal problems which have arisen are the accumulation of chemicals on the equipment as in air blast spraying, corrosion of metal parts, and abrasion caused by heavy spray suspensions. The engine and pump must be sealed against corrosive and abrasive chemicals. Synthetic rubber components, particularly those containing polysulphide (thiokol), are resistant to oil solvents. Vitreous enamel is a suitable coating for cylinders in plunger pumps, giving good abrasion resistance. In order to reduce abrasion at the nozzle, chromium-cobalt-tungsten alloys are employed in place of hardened steel, or else ceramic materials, or tungsten, or chromium carbide metals may be used. The corrosion of steel spray tanks is a particularly acute problem, and owing to the cost of a whole stainless steel tank resistant coatings are being investigated to combat corrosion. Heat-curing epoxy and phenotic resin coatings possess very high solvent resistance, and porcelain enamel coatings are resistant to chemicals. Tanks of fibreglass-reinforced polyester resin are satisfactory though expensive. Prepainting treatments to improve adhesion and thus lessen abrasive damage are also being investigated.

Ripper (W. E.). **Application methods for crop protection chemicals.**—*Ann. appl. Biol.*, 42 (*Proc. Jubilee Meeting, London, 13–17 Sept., 1954*), pp. 288–324, 2 pl., 2 graphs, 1955.

The author reviews and discusses the present state of knowledge concerning the application of protective chemicals to crops (1) directly to or by injection into the

plant: (2) by release into the air with diffusion to the target (crop and tree fumigation): (3) by release or propulsion through the air to the target either (a) in the solid or (b) in the liquid state: (4) by injection into the soil: and (5) by release into irrigation water. Section 3b deals with the physics of the spray process, the fate of spray droplets, spray drift and cover, types of spray required, i.e. space, systemic, and contact sprays, and types of equipment, i.e. hydraulic sprayers, spray and mist blowers, and aerosol generators. The greatly increased range of apparatus now available requires that a deeper study should be made of the biological effects of the various dispersion systems. There is a bibliography of 108 references.

How to spray the aircraft way.—*Farmers' Bull. U.S. Dep. Agric.* 2062, 31 pp., 18 figs., 5 graphs, 1954.

In this popular account of all the aspects of aircraft spraying, information for both the farmer and the pilot is included, covering choice and care of equipment, aircraft performance, legal aspects, safety measures, and the calculation of pesticide mixtures and acreage.

Chester (K. S.). **Scientific and economic aspects of plant-disease-loss appraisal.**—*Ann. appl. Biol.*, 42 (*Proc. Jubilee Meeting, London, 13–17 Sept., 1954*), pp. 335–343, 1955.

It is estimated that during the period 1942–51 one-tenth of the potential farm production in the United States was lost through plant disease [*R.A.M.*, 31, p. 73; 33, p. 41]. Estimation of losses sometimes reveals striking figures. For 20 years no estimate was made of the damage caused by virus X, discovered in 1925 and present in almost every potato plant grown in America except seedlings. The loss was then ascertained to average 13 per cent. of the crop [cf. 28, p. 479], twice the average annual loss from the common fungus diseases combined and four times the loss from late blight [*Phytophthora infestans*] alone, amounting during the 20-year period to more than one billion [1,000 million] bush. Published estimates of losses are sometimes highly erroneous [32, p. 623]: for example, though total cotton losses were stated by the United States Department of Agriculture to be less than 2 per cent., in Texas alone the loss from root rot [*Phymatotrichum omnivorum*] has been reliably calculated at $100 million per year.

In estimating losses [31, p. 73], a field in which England at present leads, it is desirable to determine the amount of disease [see next abstract], which is the product of its prevalence and its intensity in individual plants, and to translate this into loss expressed either as a percentage of the potential disease-free crop or in production units, and finally to interpret the effect on the economy of the country. The methods used in different regions and seasons should be comparable. They should also be objective. As far as possible appraisal should include all forms of loss, quantitative, qualitative, direct, and indirect. Consideration should also be given to all the various factors that can affect the degree of loss, including crop variety, physiologic strain of pathogen, stage of development of plant when attacked, rate of development of infection, intensifying or ameliorating effect of environmental factors, and combined effect of two or more factors acting concurrently. The first problem is to create an awareness among agricultural scientists of the need for better information on losses, then to achieve fuller recognition of the value of such information by the governments concerned. As the work grows an increasing need for international co-operation will doubtless become apparent.

Large (E. C.). **Methods of plant-disease measurement and forecasting in Great Britain.**—*Ann. appl. Biol.*, 42 (*Proc. Jubilee Meeting, London, 13–17 Sept., 1954*), pp. 344–354, 3 maps, 1 diag., 2 charts, 1955.

A brief review of the development of plant-disease measurement in Great Britain

[cf. *R.A.M.*, 33, p. 244 and preceding abstract] is followed by examples of methods of mensuration [33, p. 726; 34, p. 635, *et passim*].

The most recent application of present methods is to tulip fire [*Botrytis tulipae*: cf. 33, p. 355]. A comprehensive scheme must take into account the whole life-history, in this case the four phases of the disease, namely, the sclerotial stage on the bulbs, the primary infectors, the non-aggressive flower spotting, and the aggressive attack on the foliage. A key diagram, prepared from a detailed study and measurement of diseased plants, enables the varying degrees of infection to be readily recognized in the field without measurements being necessary.

For all foliage diseases the categories for degree of infection refer, wherever possible, to the percentage of the total green area rendered inoperative for photosynthesis. The work on cereal rusts [*Puccinia* spp.] and mildew [*Erysiphe graminis*] necessitated the preparation of a growth chart for wheat [34, p. 634]. Care is needed to distinguish between the effect of disease and normal senescence.

By conducting defoliation experiments on a sufficient number of healthy plants of each cereal it is hoped to formulate a working rule for determining how many leaves are really operative for photosynthesis at each stage of growth. This would greatly simplify the problem of mildew and rust assessment and help to relate disease assessments to loss of yield.

Tasks already completed [33, p. 726] are reviewed. Diseases affecting quality rather than quantity, such as potato scab [*Actinomyces scabies*: 34, p. 811] and apple scab [*Venturia inaequalis*: cf. 32, p. 385] are subjected to 'blemish-assessment'. The paper concludes with a review of work on potato blight [*Phytophthora infestans*: 32, p. 584; 33, p. 244] with particular reference to forecasting by the Beaumont rule in Great Britain.

Del Cañizo Gómez (J.) & González de Andrés (C.). **Manual práctico de fitopatología y terapéutica agrícola.** [Practical manual of phytopathology and agricultural therapy.]—xxiv—557 pp., 2 col. pl., 287 figs., 33 diags., Madrid, Ministerio de Agricultura, Dirección General de Coordinación, Crédito y Capitación Agraria, 1955. 150 pesetas.

This volume is intended as a practical guide and reference book for field-workers and technicians. Part I (chapters I to VII) entitled 'Concepts of agricultural phytopathology' covers the elements of plant pathology and microbiology and devotes a chapter to health inspection and defence services. Part II (chapters VIII to XV), 'Concepts of agricultural therapy', is concerned with the properties, methods of application, and dosage of the current fungicides and therapeutants, and deals with fungicides, spraying apparatus, and dusting equipment. Part III, on field experiments (chapters XVI to XXII) covers the use of dusts and sprays in the field, tree fumigation, disinfection of granaries and warehouses, and disinfection of seeds and seedlings. Part IV (chapters XXIII to XXX), concerning the symptoms and control of the chief diseases of cultivated plants, refers to diseases of the vine, the olive, fruit trees, cereals and legumes, potato, beetroot, and cotton.

Handbook of Food and Agriculture.—vii—1039 pp., New York, Reinhold Publishing Corporation; London, Chapman & Hall, Ltd., 1955. £5.0.0.

Among the 26 contributions (each followed by a bibliography) to this valuable compendium, which is under the general editorship of F. C. Blanck, may be mentioned (3) soil microbiology (pp. 73–87, 1 fig.) by C. Thom; (5) insecticides, fungicides, and herbicides (pp. 145–191) by C. C. Roan; (10) storage of agricultural raw products (pp. 305–329) by W. T. Pentzer; (11) food preservation (pp. 331–363) by C. R. Fellers; and (13) food spoilage and deterioration (pp. 389–410) by H. E. Goresline.

Pflanzenschädlinge und Pflanzenkrankheiten. Große Sowjet-Enzyklopädie, Reihe Biologie and Agrarwissenschaft, Heft 6. [Plant pests and plant diseases. Large Soviet Encyclopedia, Series Biology and Agricultural Science, Part 6.]—66 pp., 5 pl., 1 fig., Deutscher Bauernverlag, Berlin, 1953. [Review in *PflSch-Ber.*, 15, 1–3, p. 35, 1955.]

This is a German translation of a section of the Soviet Encyclopedia and deals with diseases of crops and the problems of plant protection and their solution in the Soviet Union. Ten instalments, each an individual pamphlet, have so far been published.

Russell (Sir E. J.). **The changing problems of applied biology.**—*Ann. appl. Biol.*, 42 (*Proc. Jubilee Meeting, London, 13–17 Sept., 1954*), pp. 8–21, 1955.

The author first outlines the history of the teaching of agricultural science in the British Isles from its beginning in 1891 up to the outbreak of war in 1914. Then the Government devoted a large sum of money to scientific research, the great industrial groups established their own research organizations, and the Ph.D. degree was instituted. Two new British industries, synthetic organic chemistry and scientific instrument making, markedly affected biological research, and the new subjects of mathematical statistics and atomic physics have become increasingly prominent.

Great changes have been brought about by the development of synthetic industrial chemistry, especially the production of systemic insecticides and fungicides. New fields have also been opened by the study of antibiotics, and research on virus diseases has involved full use of such new discoveries as the electron microscope.

Problems of disease avoidance and resistance and the building up of disease-free stocks call for co-operation between pathologists, physiologists, and plant breeders. Considerable new developments have arisen from the discovery of growth-promoting substances. The need for continual conference and co-operation between the growing numbers of specialists pursuing their ever-increasing diversity of subjects is stressed.

Stakman (E. C.). **Progress and problems in plant pathology.**—*Ann. appl. Biol.*, 42 (*Proc. Jubilee Meeting, London, 13–17 Sept., 1954*), pp. 22–33, 2 pl., 1955.

The author reviews the study of plant pathology in the United States during the last fifty years. After touching on the importance of quarantine and seed certification, the improvements in fungicides, the losses saved by use of resistant varieties, and the protection of stored products, the problem of stem rust of wheat (*Puccinia graminis tritici*) is dealt with in detail as an example of a major destructive disease often still not effectively controlled [*R.A.M.*, 34, p. 286 *et passim*].

The salient facts of the epidemiology of stem rust are outlined, together with the important part played by the barberry as the alternative host and the steps taken to eradicate it in the United States. The wintering of the rust in the south and its spread northwards each summer are described, and the extent of the breeding problems raised by the appearance of new strains of rust able to parasitize potentially resistant varieties is discussed, with an account of the solutions to these so far obtained.

It is pointed out that the majority of pathogens comprise large numbers of biotypes which increase the difficulties of the plant breeder seeking disease resistance. The essential part played by continued research in solving ever new problems is made clear.

Neatby (K. W.). **Research trends in Canadian agriculture and forestry.**—*Ann. appl. Biol.*, 42 (*Proc. Jubilee Meeting, London, 13–17 Sept., 1954*), pp. 45–64, 1955.

After drawing attention to the wide range of climatic conditions in which agri-

culture and forestry are practised in Canada, the author briefly summarizes the historical development of organized agricultural research in the Dominion since the establishment of the Central Experimental Farm, Ottawa, in 1886. Among the widely different research programmes described in greater detail is that on wheat breeding [cf. preceding abstract].

Marcus (S.). **Disposable Petri-type dish.**—*Science*, 122, 3173, pp. 762–763, 1 fig., 1955.

A Petri dish, manufactured by A. S. Aloe Co., St. Louis, Missouri, from paper and plastic materials has been found to be fully reliable for the usual bacterial purposes and inexpensive enough to be discarded after being used once. The dish is approximately the same size as the standard dish, the walls are of heavy paper, and the tops and bottoms of cellophane or similar transparent material. The dishes can be sterilized in the autoclave without any discernible change in shape or composition of the materials, but not by dry heat.

Nobécourt (P.) & Barnoud (F.). **Préservation des pâtes et des papiers contre les moisissures.** [Preservation of pulps and papers against moulds.]—*Bull. Ass. tech. Ind. papet., 1955*, 2, pp. 35–44, 4 figs., 1955.

This is a survey, based largely on recent Swedish, Finnish, and American studies, of information on the prevention of fungal damage to pulp and paper. In a concluding section on the preservation of books and documents, reference is made to the practice at the French National Library of vaporization with formol or thymol, the former operating for a fortnight and the latter for a month. Another very practical method consists in the intercalation between the pages of sheets of paper which have been impregnated with a 0·1 per cent. solution of pentachlorophenate and thoroughly dried. In a thesis by P. Sée (Paris, 1919), *Penicillium glaucum*, *Trichothecium roseum*, *Cladosporium herbarum*, *Acrostalagmus cinnabarinus* [*Nectria inventa*], and *Chaetomium chartarum* were described as frequent occupants of the variously coloured spots on the pages of books and archives [cf. *R.A.M.*, 32, p. 583 *et passim*]. He and other workers have shown that rag paper is much more resistant to moulds than that made with chemical or mechanical pulp, and it is, in fact, frequently observed by librarians and archivists that papers several centuries old are in a better state of preservation than those of the latter part of the 19th century and even later.

Lloyd (A. O.). **A soil-infection method for the testing of textiles for resistance to microbiological attack.**—*J. Text. Inst.*, 46, 10, pp. T653–T661, 3 figs., 1955.

Following a presentation of the ancillary factors involved in assaying the efficiency of treatments for the protection of textiles against fungal damage and a discussion of the incidental difficulties, due mainly to the sensitivity of micro-organisms to environmental variations, a method is fully described from the Textile Institute, Manchester, in which physical conditions can be standardized to a greater degree than hitherto [cf. *R.A.M.*, 25, p. 516].

Strips of cloth or yarn treated with rot-proofing chemicals or untreated as controls are partially coated with a suspension of top soil and 'spent' mushroom compost, thickened to a paste with kieselguhr, inoculated, e.g., with *Stachybotrys atra* [34, p. 536], and incubated in rectangular tanks, 8 by 4 by 10 in., constructed of $\frac{1}{4}$ in. perspex sheet. By means of asbestos plugs of standard size and weight, holding a fixed amount of water, moisture conditions within the strips are graduated from total saturation to mere dampness. Mould and rot resistance are assessed simultaneously, the former visually and the latter either by determining the loss of strength after a given period of exposure or by recording the time required to reach the stage where the sample breaks on gentle pulling.

After 28 days' incubation four samples of grey cotton duck treated with 2 per cent. pentachlorophenyl laurate were mould-free and showed no reduction in breaking strength, whereas the controls exhibited incipient infection after three days and were overgrown by [unspecified] green, black, and grey moulds at the end of a week; after a fortnight, moreover, they broke easily and by this time patches of *S. atra* had developed on the portions in contact with and above the soil. In another series of tests with an [unnamed] proprietary rot-proofing agent, a period of 71 to 77 days was required for 10 treated samples of scoured and bleached cotton duck to reach the stage of breaking at a gentle pull, compared with only 16 to 17 for the controls. During the entire experimental period the treated samples remained free from mould, while the controls (which were in a comparatively clean state to begin with) developed small, green spots in three weeks.

Boidin (J.) & Abadie (F.). **Les levures des liqueurs tannantes végétales ; leur action sur les tanins pyrogalliques.** [The yeasts of plant tanning liquids: their effect on pyrogallic tannins.]—*Bull. Soc. mycol. Fr.*, 70, 4, pp. 353–383, 10 figs., 2 graphs, 1954. [Received 1955.]

Over 100 yeasts [*R.A.M.*, 31, p. 567] belonging to 22 species, 5 sporing and 17 non-sporing, were isolated from tanning liquids obtained from the wood, bark, leaves, and fruits of various plant species. *Saccharomyces* spp. with hat-shaped spores and little or no fermentative ability are accommodated in a new genus *Petasospora*. The use of chromatographic and colorimetric techniques demonstrated that only *P. strasburgensis* and *Pichia pseudopolymorpha* [cf. 31, p. 354] were able to decompose the pyrogallic tannins, the former liberating pyrogallol and the latter gallic acid.

Bracken (A.). **The chemistry of micro-organisms.**—vii—343 pp., London, Sir Isaac Pitman & Sons, Ltd., 1955. 30*s*.

This manual comprises the following chapters: (I) micro-organisms and enzymes; (II) synthetic powers of micro-organisms; (III) bacteria and moulds in nature; (IV) micro-organisms in production; (V) the story of penicillin; (VI) streptomycin and some other antibiotics; (VII) pigments and colouring agents; (VIII) conversion of sugars into aromatic compounds; (IX) aliphatic and heterocyclic compounds; (X) inorganic chemistry and micro-organisms; (XI) micro-organisms and changes in their environment; (XII) micro-organisms in the laboratory; and (XIII) micro-organisms in a changing world.

Mukherjee (S. K.) & Nandi (P. N.). **Studies on the antagonistic actinomycetes from the soils of West Bengal.**—*Indian Phytopath.*, 8, 1, pp. 64–71, 1955.

Of 170 *Streptomyces* spp. isolated at the Bose Research Institute, Calcutta, from West Bengal soils [*R.A.M.*, 34, p. 238] 68 were antagonistic towards Gram-positive bacteria, 38 to Gram-negative bacteria, and 54 to fungi, including *Helminthosporium oryzae* [*Ophiobolus miyabeanus*]. Different isolates of the same species of *Streptomyces* possessed different antagonistic properties, and some that exhibited antagonism in the agar-streak method failed to do so in the agar-cup method.

Thirumalachar (M. J.). **Chainia, a new genus of the Actinomycetales.**—*Nature, Lond.*, **176**, 4489, pp. 934–935, 1 fig., 1955.

An actinomycete isolated from soil in Poona, India, was placed in a new genus *Chainia* with the following features: a well-developed, fine, non-septate mycelium growing into the substrate, non-fragmenting, Gram-positive, non-acid-fast, developing sclerotic granules composed of incurled hyphal cells, single or aggregated, enveloped in a hyphal sheath at first and later becoming free. The type species, *C. antibiotica*, produced an extremely powerful anti-fungal substance both on agar

plates and in agitated submerged cultures. The diameter of the inhibition zones on glucose peptone agar plates incubated for five days at 24° C. were 60 mm. for *Curvularia lunata* and 45 mm. for *Botryodiplodia* [*Macrophomina*] *phaseoli*.

BUXTON (E. W.) & RICHARDS (MARILYN G.). **Pathogenic strains of Fusarium oxysporum Fr. distinguished by their differential tolerance to inhibition by various actinomycetes.**—*J. gen. Microbiol.*, 13, 1, pp. 99–102, 1 pl., 1955.

Fusarium oxysporum comprises many pathogenic strains indistinguishable in culture, each *forma specialis* including a number of physiologic races. The following method for distinguishing certain isolates was devised in the Plant Pathology Department, Rothamsted Experimental Station. Sixteen soil actinomycetes (A1 to A6, A9, A14, A16, A17, A19, and A26 to A30) were tested for their inhibitory action against eight pathogenic races of *F. oxysporum* [*R.A.M.*, 33, p. 446], viz., f. *pisi* races 1 (71B), 2 (72B), 3A (611A), and another (612A) equivalent in pathogenicity to 71B, and var. *redolens* (51A), all from wilted peas; f. *gladioli* (F1), a yellow strain and (F2), a yellowing and rotting strain, both from gladiolus; and 61A, a soil isolate non-pathogenic to peas. Single streaks of an actinomycete on plates of a starch-tryptone agar medium were incubated for five days at 25° [C.]; streaks of *Fusarium* (as spore suspensions of uniform density) were then made parallel to and 3 mm. from the actinomycetes and the plates incubated for a further five days.

The actinomycetes A4, A14, and A17 strongly inhibited all eight *Fusarium* races; A1, A3, A9, A19, A28, and A30 inhibited them less markedly, while A2, A6, and A29 were eventually overgrown. A5, A16, A26, and A27 consistently inhibited the individual isolates to different extents, those strongly inhibited having advancing edges composed entirely of tightly packed, stunted hyphae and those partially inhibited having subnormally-branched marginal hyphae. A5, identified as a strain of *Streptomyces albido-flavus* [33, p. 629], inhibited 72B markedly but 611A far less so. Differences in inhibition analogous to those observed by the streak method were obtained when porcelain cylinders containing 0·1 ml. of the filtrate of a liquid culture of *S. albido-flavus* were placed on the surface of 10 ml. of the agar seeded with *Fusarium* spores. This technique would appear, therefore, to afford a simple means of distinguishing between *F. oxysporum* isolates *in vitro*.

RIBALDI (M.). **Osservazioni preliminari sull'attività antibiotica di Camarosporium sp.** [Preliminary observations on the antibiotic activity of *Camarosporium* sp.]—*Ann. Sper. agr.*, N.S., 8, 4, pp. 1043–1053, 3 pl., 1954. [English summary.]

In 1953 a culture of a species of *Camarosporium* saprophytic on olive trees in Perugia, Italy, was observed to be antagonistic towards a species of *Torula* contaminating the dish. A similar effect was ascertained experimentally to be exerted upon 16 species of fungi, mostly plant pathogens, as well as upon certain species of bacteria.

Production of the active, antibiotic principle was greater on solid than on liquid media and on carrot agar than on potato agar. When *Botrytis cinerea* and *Monilia* [*Sclerotinia*] *fructigena* were grown on potato agar on which the fungus had been cultured for 80 days, a fungistatic effect on the germination of their conidia was observed, which was lessened when the medium was diluted.

The metabolic products of the fungus were found to contain polyphenolic derivatives, which may constitute the active, antibiotic principle.

TREGGI (G.). **Sulla utilizzazione di alcuni aminoacidi da parte di funghi fitopatogeni.** [On the utilization of some amino acids by phytopathogenic fungi.]—*Ann. Sper. agr.*, N.S., 8, 6, pp. 1955–1963, 2 figs., 1954. [English summary.]

Continuing his earlier investigations, the author studied the effect of certain

amino acids on the growth of *Alternaria solani*, *Endothia parasitica*, *Fusarium lini*, *Rosellinia necatrix*, *Sphaeropsis dalmatica*, and *Verticillium albo-atrum* [cf. *R.A.M.*, 32, p. 548]. On Czapek-Dox's liquid medium DL-aspartic acid, glycine, leucine, DL-treonine, and a trace of L- and DL-tryptophane were utilized, but they were of small value as sources of nitrogen, the fungi appearing to lack vigour, sometimes with malformed hyphae, or occasionally excessive vacuolization. In general only DL-aspartic was used as a source of both carbon and nitrogen and to a limited extent; leucine, however, was used to a moderate extent by *F. lini* and somewhat less by *R. necatrix*. The presence of α-aminovalerianic acid in Sahyun's medium at pH6 favoured the growth of *F. lini*, *R. necatrix*, *S. dalmatica*, and *E. parasitica*, provided the amount present did not exceed 0·5 to 1 per cent. The greater the amount of glucose in the medium, the more marked was the favourable effect of this acid on fungal growth.

Grasso (V.). **I nuclei delle ascospore della Sclerotinia sclerotiorum (Lib.) Massee e la loro eventuale identificazione con le guttule.** [The nuclei of the ascospores of *Sclerotinia sclerotiorum* (Lib.) Massee and their eventual identification with the guttulae.]—*Ann. Sper. agr.*, N.S., 9, 1, pp. 225–230, 5 pl., 1955. [English summary.]

In studies at the Phytopathological Observatory, Florence, in which sclerotia of *Sclerotium sclerotiorum* isolated from celery were germinated, the author observed that the ascospores, after staining, contained two distinct dark, punctiform bodies, exactly in the position in which oil-drops have consistently been recorded. These could not possibly be oil-drops, which would not have resisted so many passages through alcohol and xylol and then assumed a colour so characteristic of nuclei, nor would they have been present in constant number and at fixed points. They must, therefore, be considered to be two nuclei. It cannot be definitely asserted that the oil-drops present in *S. sclerotiorum* in the fresh state are identical with the nuclei observed in the fixed material in paraffin, but the evidence suggests that this is, in fact, the case.

Sörgel (G.). **Zur Wirkung der Temperatur auf die Größe von Pilzsporen.** [On the influence of temperature on the size of fungus spores.]—*Naturwissenschaften*, 42, 20, pp. 565–566, 2 graphs, 1955.

Using the filter-paper technique already described [*R.A.M.*, 32, p. 492], the author investigated the influence of temperatures ranging from 4° to 36° C. on a number of fungi at the Institute for Plant Breeding, Quedlinburg, Germany. Among the species attaining maximum spore dimensions at 12° were *Alternaria raphani*, *Colletotrichum lindemuthianum*, *Mycosphaerella pinodes* [34, p. 425], and *Trichothecium roseum*. In various species, e.g., of *Fusarium*, with multicellular spores, the number of cells increased and decreased *pari passu* with conidial measurements. Thus, in *Gibberella baccata* [31, p. 597] quinqueseptate forms predominated among the conidia produced at the optimum temperature of 16°, which were $37{\cdot}04 \pm 0{\cdot}14\,\mu$ in length, and uniseptate in those developing at 32° ($25{\cdot}39 \pm 0{\cdot}16\,\mu$).

Müller (H. J.) & Unger (K.). **Über die Bedeutung der Zusammenhänge zwischen Witterung und Blattlausflug für die Probleme des Kartoffelabbaus.** [On the significance of relations between weather and aphid flight in the problems of Potato degeneration.]—*Forsch. Fortschr. dtsch. Wiss.*, 29, 7, pp. 229–238, 1 diag., 3 graphs, 2 maps, 1955.

This is a critical discussion of some outstanding contributions to the literature on meteorology and aphid movements in relation to problems of potato degeneration of virus origin, with special reference to Germany [*R.A.M.*, 34, p. 668 *et passim*].

Hille Ris Lambers (D.). **Potato aphids and virus diseases in the Netherlands.**—*Ann. appl. Biol.*, 42 (*Proc. Jubilee Meeting, London, 13–17 Sept., 1954*), pp. 355–360, 1955.

The author recapitulates the research on aphids in relation to the transmission of potato leaf roll virus in Holland [*R.A.M.*, 32, p. 639; 34, p. 474], where extensive field work was begun in 1936. Observations on aphids in relation to their enemies disclosed a biennial rhythm, one or other predominating in alternate years. In 1949 evidence was obtained that during the migration period from winter to summer host over 97 per cent. of the alatae of *Myzus persicae* arriving on potato came from peach or *Prunus serotina*. The main spread occurs in July and is caused by alatae developed on potatoes and other herbaceous plants. This has determined certain aspects of seed-potato growing for about 150 years; even in 1810 Friesian seed-growers lifted their seed potatoes early to prevent attack by leaf roll. The best four grades of potatoes are not certified unless lifted before a fixed date, which varies according to the variety, grade, and region where the 'seed' is grown.

In conjunction with trapping experiments in 1951 virus spread was measured by sampling tubers twice a week. Numbers of alate *M. persicae* were caught in northern regions during a period when local growers felt quite safe because they had very few aphids in their crop. These alatae were not correctly estimated in summer by counting on the plants and it was apparent that there was not necessarily a correlation between the number of aphids on the plant and virus spread. Nevertheless, experiments with systox further confirmed the supreme importance of flying aphids as vectors of virus.

Dates for early lifting, based partly on a long-term aphid forecast, are now prescribed. Trap catches make it possible to warn regions where aphid flights reach a critical level.

Morel (G.) & Martin (C.). **Guérison de Pommes de terre atteintes de maladies à virus.** [Cure of Potatoes infected by virus diseases.]—*C. R. Acad. Agric. Fr.*, 41, 10, pp. 472–475, 1955.

Certain potato varieties, although chronic virus-carriers, continue to be grown for their good commercial qualities [cf. *R.A.M.*, 33, p. 706]. The authors have applied to infected potatoes, their method, successfully developed on dahlias [32, p. 191], of isolating virus-free apical meristems. After two to three months a number of small plants grew and were grafted on to healthy tomato plants, on which they developed normal leaves within a month. Cuttings subsequently produced four to six tubers each. By this method plants of Early Rose, Eesterlingen, and Fin de Siècle free from virus X [cf. 35, p. 118] were obtained, Belle de Fontenay free from virus Y, and Saucisse and Primel free from virus A.

McKay (R.) & Loughnane (J. B.). **Effects of single strains of virus X, of virus A, and of crinkle (X+A) on three Potato varieties; and observations on the progeny of these plants in 1953.**—*J. Dep. Agric. Eire*, 50, pp. 94–103, 1953–54.

This is a condensed version of a paper already noticed from another source [*R.A.M.*, 33, p. 109].

Bartels (R.). **Der serologische Nachweis des X-Virus in Lichtkeimen der Kartoffel.** [The serological detection of virus X in Potato sprouts exposed to light.]—*NachrBl. dtsch. PflSchDienst* (*Braunschweig*), *Stuttgart*, 7, 3, p. 43, 1955.

The shoots of potato tubers sprouted in the dark contain sufficient virus X to allow detection [cf. *R.A.M.*, 31, p. 453]. In tests at the Institute for Virus Serology, Brunswick, Germany, with the varieties Bona, Flava, Merkur, and Erstling [Duke of York] it was found that serological detection of virus X is also possible with those sprouted in the light, regardless of differences in temperature or time

of year. Such sprouts, however, contain much smaller mounts of virus than those kept in darkness, and greater care is necessary in obtaining the sap and in diluting it.

SILBERSCHMIDT (K.) & ROSTOM (E.). **A valuable indicator plant for a strain of Potato virus Y.**—*Amer. Potato J.*, 32, 6, pp. 222–227, 3 figs., 1955.

Leaves of *Nicandra physaloides*, rubbed with sap from White Burley tobacco infected with a virus considered to be a strain of potato virus Y [*R.A.M.*, 34, p. 264], and called the necrotic-fleck strain by the authors, after seven to 12 days developed faint necrotic rings with a green centre, the necrotic border around which broadened and turned dark purple, some lesions finally becoming dark necrotic disks. In addition to these local symptoms the virus also induced systemic symptoms, chlorotic spots, on younger leaves.

After a review of differential hosts of potato virus Y described in the literature, the authors conclude that these necrotic rings represent differential and distinctive symptoms of the necrotic-fleck strain of this virus, and that this type of symptom is local but not primary, and has not hitherto been adequately distinguished from commoner local symptoms. They resemble those described by MacLachlan *et al.* (*Res. Bull. Univ. Wis.* 180, 35 pp., 1953) as characteristic of potato virus A. It is important when using *N. physaloides* as an indicator for strains of potato virus Y to exclude other viruses [34, p. 55].

MUNRO (J.). **The reactions of certain solanaceous species to strains of Potato virus Y.**—*Canad. J. Bot.*, 33, 4, pp. 355–361, 2 pl., 1955.

At the Plant Pathology Laboratory, Fredericton, New Brunswick, the reactions of various solanaceous hosts to eight strains of potato virus Y [*R.A.M.*, 32, p. 274] were studied in a search for differentials for strains not clearly distinguished on potato. The viruses were maintained in White Burley tobacco and sap inoculated. Strain Y3 was unable to infect *Physalis floridana*, while the other strains produced necrotic lesions, those causing mild symptoms in potato inducing severe ones in *P. floridana* and vice versa [32, p. 639]. Four of the test strains caused an acropetal necrosis in *Nicotiana rustica*, similar to the leaf drop streak characteristic of many strains of virus Y in potato. Y3 produced very severe necrosis and distortion in *N. sanderae*, while with four other strains there was only a transient vein-clearing followed by vein-banding. On White Burley tobacco the only distinctive strain reaction was that of tobacco veinal necrosis virus [31, p. 201]; Y2, Y4, and Y6 partially protected the plants from infection by this strain.

It is concluded that the differences between strains of a virus become more obvious with a wider range of indicator plants. The test strains of potato virus Y maintained their differences uniformly throughout the experimental work. Y4 and Y6 possibly occupy an intermediate position between tobacco veinal necrosis virus and the other Y strains. The cultivation of new potato varieties hypersensitive to common strains of virus Y [34, p. 609] may encourage the multiplication of certain strains at present uncommon in the field.

WEBB (R. E.). **A new strain of the Potato leaf roll virus.**—*Amer. Potato J.*, 32, 5, pp. 173–179, 3 figs., 1955.

Comparative studies of the mild strain 1 of the potato leaf roll virus and a new strain isolated from resistant potato seedling X927–3 showed that the latter differed in becoming systemic in *Datura stramonium* more slowly, in its degree of symptom development, and in its erratic incubation period in the potato varieties Katahdin, Chippewa, Red Warba, Russet Burbank, and the seedlings X927–3 and 41956. In cross-protection tests the new isolate prevented reinfection of infected plants with strain 1: it is proposed to name it strain 5.

Heilmann (Ursula). **Über den Nachweis von Blattrollvirus in Kartoffelknollen mit Hilfe eines Fluoreszenzfarbstoffes.** [On the detection of leaf roll virus in Potato tubers by means of a fluorescent stain.]—*NachrBl. dtsch. PflSchDienst (Braunschweig), Stuttgart*, 7, 3, pp. 44–45, 1955.

Following up the methods of Bode [*R.A.M.*, 27, p. 123] and Strugger [28, p. 8] the author detected leaf roll virus in potato slices [34, p. 747] by staining for 15 to 20 minutes in a 0·01 per cent. solution of the fluorescent acridine orange [34, p. 171] with the addition of 0·5 per cent. ethyl alcohol, but this method has the disadvantage of requiring ultra-violet light.

The protoplasm can be stained shortly before death from injury, and in the hope that virus infection would constitute a suitable injury, narcotics and other substances likely to weaken the protoplasm were added to increase the injurious effect and hence the staining capacity. Acridine orange causes injury to the neighbouring protoplasm when exposed to light, and additional staining with normal dyes was possible, so that the acridine orange became visible in normal light. A mixture of 0·005 per cent. acridine orange, 0·01 per cent. Bordeaux red, and 0·3 M. solution of potassium chloride, with a pH between 3·7 and 4, gave the required result after exposing the tuber slices to light for 15 minutes, though fully mature tubers would not stain. Tubers affected by leaf roll virus then have the phloem (or often only individual cells) stained dark red and clearly distinguishable from the practically uncoloured neighbouring cells. This method indicated more plants to be virus carriers than appears in the field.

Graham (K. M.). **Distribution of physiological races of Phytophthora infestans (Mont.) De Bary in Canada.**—*Amer. Potato J.*, 32, 8, pp. 277–282, 1955.

A gene conferring resistance to race 0 of *Phytophthora infestans* [see above, p. 158] was found in strain Geneva T-5 of *Lycopersicon esculentum* var. *cerasiforme*. In crosses with the susceptible tomato variety Stokesdale this gene proved a simple dominant.

Isolates of *P. infestans* from material collected during 1952 and 1953 in nine provinces of Canada [*R.A.M.*, 34, p. 808] were grouped into eight races: of the 70 isolates obtained 11 were apparently mixtures of 0 and 4, and two of races 1^t and 1^t 4 [34, p. 554]. Races 0 and 4 were obtained from commercial potato and tomato varieties lacking genes for resistance. Race 1^t occurred on the tomato varieties Geneva T-5 and Rutgers and race 1^t 4 on the potato Snowflake. It was concluded that the so-called common race of *P. infestans* is in fact composed of races 0 and 4.

It is suggested that the mycelium of the fungus as it grows in natural hosts is heterokaryotic and that both the natural hosts and artificial culture media may exert selective influences upon components of the common race [cf. 34, p. 391]. A single zoospore culture of race 0 has been maintained on artificial media for two years without change of host relationships, nor have monospore cultures of 1 or 1,2,4 shown any change in their ability to attack appropriate hosts.

Swaminathan (M. S.). **Overcoming cross-incompatibility among some Mexican diploid species of Solanum.**—*Nature, Lond.*, 176, 4488, pp. 887–888, 2 figs., 1955.

During the summer of 1953 a systematic survey was made of the crossing ability of Mexican diploid species of *Solanum* [*R.A.M.*, 34, p. 242] at the Inter-Regional Potato Introduction Station, Sturgeon Bay, Wisconsin, with a view to selecting material resistant to blight (*Phytophthora infestans*) [see preceding abstract]. Failure appeared to be due to non-germination of the pollen. This problem was overcome by removing the stigma and a small portion of the style from flowers of *S. pinnatisectum*, applying a small drop of an agar-sucrose-gelatin medium

(0·5–2·5–0·5 gm. in 25 ml. distilled water) to the decapitated surface and then pollen grains, and covering the style with moist cotton wool. Seeds from the crosses *S. pinnatisectum*×*S. lanciforme* and ×*S. bulbocastanum* obtained in this manner were grown at Sturgeon Bay in the summer of 1954. The hybrid between *S. pinnatisectum* and *S. bulbocastanum* [34, p. 57] may be of particular interest as a breeding stock since the latter was recently reported as being not only resistant to *P. infestans* but probably the only species immune from it [33, p. 315].

Schippers (P. A.). **Some factors influencing the keeping quality of Potatoes.**—*Netherlands J. agric. Sci.*, 3, 4, pp. 305–310, 1955.

Two methods of ascertaining the microbiological keeping quality of potato tubers were used in the studies herein described from the Agricultural College, Wageningen, involving storage either at a constant temperature of 2° C. or in an unventilated, insulated shed, in which the temperature fluctuated according to that of the outside air. The former requires one to two years as compared with less than one for the latter, but the differences revealed are more distinct. The numbers of rotted tubers are counted at fixed times. Decay was found to be caused predominantly by *Fusarium* [? *caeruleum* and *F. avenaceum*: *R.A.M.*, 30, p. 428].

It has long been known that potatoes grown on clay soils tend to rot earlier than those from sand, but the current investigations disclosed marked variations in the keeping quality of tubers from different sandy plots. A high humus content, a low pH value, and a low potash number were associated with inferiority in this respect, and the results of field experiments indicated that late applications of potash, i.e. on 16th June and 4th July, exert a preservative effect.

Stevenson (F. J.), Akeley (R. V.), & Webb (R. E.). **Reactions of Potato varieties to late blight and insect injury as reflected in yields and percentage solids.**—*Amer. Potato J.*, 32, 6, pp. 215–221, 1955.

Breeding for resistance to potato late blight [*Phytophthora infestans*: *R.A.M.*, 34, p. 808] in the United States has been hampered by the appearance of specialized races of the fungus which successfully attack varieties such as Cherokee, Pungo, Kennebec, Delus, Merrimack, and Saco, that are highly resistant to, if not immune from the common race, or moderately resistant, like Sebago.

It has been shown in Maine, however, that these attacks occur after the resistant varieties have produced a satisfactory crop, and at least two weeks after susceptible varieties have been badly injured by the disease. In years favourable to blight the disease was easier to prevent on resistant than on susceptible varieties; in bad years even resistant varieties will profit from copper sprays.

Akeley (R. V.), Stevenson (F. J.), Blood (P. T.), Schultz (E. S.), Bonde (R.), & Nielsen (K. F.). **Merrimack : a new variety of Potato resistant to late blight and ring rot and adapted to New Hampshire.**—*Amer. Potato J.*, 32, 3, pp. 93–99, 1955.

The new, late-maturing potato Merrimack proved resistant in haulms and tubers to the common race of late blight [*Phytophthora infestans*: *R.A.M.*, 35, p. 121], moderately resistant to early blight [*Alternaria solani*], field-immune from virus A, and highly resistant to net necrosis [26, p. 165] and ring-rot [*Corynebacterium sepedonicum*: 34, p. 102]. The haulms are susceptible to leaf roll virus [34, p. 54]. It is the first variety highly resistant to both blight and ring rot and it may replace some of the standard varieties in New Hampshire, but is inferior in yield to Kennebec and others in Maine, though its yields there warranted production of seed destined for other regions. In New England it should be planted as early in spring as possible.

Dorozhkin (N. A.) & Kustova (A. I.). Влияние микроэлементов на повышение урожая Картофеля и его устойчивость к болезням. [The effect of microelements on increased yield and disease resistance of the Potato.]—Земледелие [*Zemledelie, Moscow*], 3, 6, pp. 66–70, 1955.

In 1953 and 1954 experiments were carried out at the 'Uste' Experiment Station, U.S.S.R. Academy of Sciences Institute of Socialist Agriculture, to determine the effect of copper sulphate, potassium permanganate, magnesium sulphate, and boric acid, applied to the soil at 6, 20, 40, and 2 kg. [per ha.], respectively, or sprayed on the plants at—[? less than] 0·02, —0·01, —0·3, and —0·02 per cent., respectively, on yield and disease resistance in potatoes. The development of the plant was accelerated by four to six days, while the appearance of diseases was retarded. All the treatments resulted in increased yields and reduced the incidence of *Phytophthora infestans* and *Rhizoctonia* [*Corticium solani*: *R.A.M.*, 33, p. 753]. Potatoes sprayed with copper sulphate, which was superior to all the other treatments, were also free from black leg [*Erwinia phytophthora*: 28, p. 555] and common scab [*Actinomyces scabies*: 18, p. 611].

Treating potatoes with micro-elements for two consecutive years significantly increased their resistance to *P. infestans* and *C. solani*. There was eight to ten times less infection with *P. infestans* than in the controls (water treated) and a 44·5 per cent. yield increase as against 25 per cent. (treatment for one year only) after treatment with copper sulphate. Adding potassium permanganate to the soil at planting reduced infection by *C. solani* from 72·2 (control) to 20 per cent. and by *P. infestans* from 16·2 to 2·7 per cent., the corresponding figures for spray applications being from 69 (control) to 17·25 per cent. and from 20·7 (control) to 2 per cent.

Progenies from tubers of plants treated the previous year, particularly from plants receiving copper sulphate, were also highly resistant to those two diseases. Stored tubers from treated plants developed considerably less [unspecified] bacterial rot (0 to 2·3 per cent. as against 5·9 and 8·3 for the water treated controls), those from copper sulphate treated plants being completely free from the disease.

Cox (A. E.). **Effect of blight on yields of maincrop Potatoes.**—*J. Minist. Agric.*, 62, 3, pp. 138–141, 2 graphs, 1955.

The author made observations on outbreaks of potato blight [*Phytophthora infestans*: *R.A.M.*, 34, p. 539] in north-east Essex from 1950 to 1954. Taking into account the time of the first outbreak, date of planting, and the period of maximum yield increase [32, p. 584; 34, p. 172], especially in relation to losses from wheel damage, it appears that locally only small returns are likely from spraying King Edward; it is not worth while spraying Majestic since the disease appears late and proceeds slowly on this variety; but a late maincrop, such as Ulster Supreme, definitely requires treatment. Of prime importance is early application of fungicide. Haulm killing should be done at the 25 per cent. blight stage or two weeks before lifting. A good earthing-up is the chief factor in minimizing tuber losses from blight.

Höhener (H.). **Weitere Erfahrungen über Möglichkeiten und Grenzen bei der Verwendung wassersparender Spritzgeräte für die Schädlingsbekämpfung im Feldbau.** [Further observations on possibilities and limitations in the use of water-economizing spraying machinery for pest control in agriculture.]—*Schweiz. landw. Mh.*, 32, 3, pp. 102–108, 6 figs., 1954.

Experiments have been in progress in Switzerland for some years past with the object of effectively increasing the concentration of disinfectant sprays and decreasing the quantities of liquid applied [cf. *R.A.M.*, 34, p. 163; 35, p. 119, *et passim*]. To reduce liquid consumption to half or a third of the normal, with a corresponding increase in the strength of the chemical, the ordinary nozzles are replaced by special models with apertures 0·7 to 0·9 mm. in diameter, e.g., the Horto-Saphir-Nebel-

brause (Birchmeier & Co., AG., Künten), which necessitate a lowering of pressure to 8 to 10 atm. Similarly, the mist blower, e.g., Swissatom 350 with Aero-Bar (Berthoud S.A., Vevey), reduces liquid consumption by as much as one-fifth, while relatively fine atomization and uniform distribution is effected by the air jet.

Experiments are reported from the Agrochemical Division of Sandoz AG., Basel, on the application of these principles to the control of *Phytophthora* [*infestans*] on Bintje potatoes [34, p. 314 and next abstract]. The results were at least equal to those achieved by normal treatment, and no clogging of the nozzles was caused by the increased concentrations of copper oxide and copper oxychloride, the latter being particularly suitable for the purpose by reason of the fineness of its particles. The new procedure saves 10 to 50 per cent. of labour time.

Höhener (H.). **Zum Totspritzen der Kartoffelstauden für die Speisekartoffelproduktion.** [On Potato haulm-killing by spraying for table Potato production.]—*Schweiz. landw. Mh.*, 33, 7, pp. 276–279, 2 figs., 1955.

The destruction of potato haulms by means of strong herbicides with a DNC base presents considerable advantages over mechanical removal [cf. *R.A.M.*, 34, p. 670], e.g., the simultaneous elimination of parasitic fungi, especially *Phytophthora infestans* [see preceding abstract] and *Alternaria solani*, insect pests, and weeds. In experiments in 1954 on an estate belonging to Sandoz AG., Basel, Switzerland, the average percentages per are [100 sq. m.] of tubers infected by *P. infestans* on the untreated plots and those sprayed with 1·5 per cent. EK54 (DNC) [29, pp., 51, 577; 33, p. 172] were 10·6 and 2·3, respectively.

Feustel-Schönbrunn (Ruth). **Untersuchungen über Kulturen von Phytophthora infestans de Bary auf Nährlösungen und Agarnährböden.** [Studies on cultures of *Phytophthora infestans* de Bary on nutrient solutions and nutrient agar media.]—*Zbl. Bakt.*, Abt. 2, 108, 19–20, pp. 513–530, 7 figs., 2 graphs, 1955.

At the Institute for Phytopathology, Naumburg, Germany, the best growth of *Phytophthora infestans* on liquid media was obtained at pH 5·3 to 5·5. Germinating rye seed solution and all expressed saps from potato roots, stems, young plants, and leaves appear to contain at least one component which promotes the growth of the fungus. The best results were secured with undiluted rye seed solution and potato root solution; the other extracts were more effective at a dilution of 1 in 8. At 18° to 21° C. mycelial development was profuse and conidial production adequate on agar media supplemented by potato root and stem extracts. The growth-promoting substance in stem extracts is thermostable, not extractable with ether, ethyl alcohol, or chloroform, and shows little or no tendency to diffusion in agar. Mycelial growth was also fairly abundant in the presence of a product derived from concentrated stem extract by precipitation with methanol, which appears to contain a stimulatory factor. A similar factor is also presumed to exist among the metabolic products of bacterial contaminants of cultures of *P. infestans* [cf. 31, p. 253]. On the other hand, extracts from potato leaves, especially young ones, contain a component that inhibits the growth of the pathogen. It appears to be responsible for the dark coloration of the extracts and probably emanates from a phenol derivative.

Kaiser (W.) & Klingler (H.). **Untersuchungen über die Feldresistenz einiger Kartoffelsorten gegen Phytophthora infestans (Mont.) de Bary. Vorläufige Mitteilung.** [Investigations on the field resistance of some Potato varieties to *Phytophthora infestans* (Mont.) de Bary. Preliminary note.]—*NachrBl. dtsch. PflSchDienst* (*Braunschweig*), *Stuttgart*, 7, 2, p. 21, 1955.

The field reaction of the susceptible potato variety Sabina and the resistant Carmen to *Phytophthora infestans* [*R.A.M.*, 34, p. 173] were compared as to reduction in the rate of infection, inhibition of mycelial spread in the plant tissues,

retardation of fructification, and reduction in its intensity. Whereas fructification started on Sabina the fifth day after inoculation and became intense by the seventh day, it did not begin until the seventh day on Carmen and never became vigorous.

In 1954 certain susceptible and resistant varieties were photometrically tested for solanin content of the leaves, which at any stage averaged twice as much in the resistant varieties as in the susceptible.

Schechaj (R.). **Avaluación de las variedades de Papa según su resistencia a Phytophthora infestans (Mont.) De Bary, en plantaciones de primavera y verano en la estación experimental 'El Suncho', Catamarca.** [Evaluation of Potato varieties according to their resistance to *Phytophthora infestans* (Mont.) De Bary, in spring and summer plantings at the 'El Suncho' Experiment Station, Catamarca.]—*Rev. agron. Noroeste Argent.*, 1, 2, pp. 135–155, 8 figs., 1954. [English summary. Received 1955.]

Attempts are being made to produce healthy seed potatoes in the sub-tropical mountain districts of north-western Argentina by spring and summer planting to avoid the expense of transport from Buenos Aires province. The frequent and heavy rainfall during 1951–2 was particularly favourable for the development of *Phytophthora infestans* in summer plantings at the 'El Suncho' Experiment Station (1,850 m.), permitting an evaluation of varietal reaction [*R.A.M.*, 30, p. 537; 35, p. 121]. Plants of the susceptible varieties Sequoia, Sebago, Alma, Pontiac, Huinkul [? Heinkel], Katahdin, and White Rose were completely destroyed, but they may be grown in the spring provided that *P. infestans* is controlled. Spring-planted Sequoia and Pontiac gave the highest yields. The European varieties 477, 490–558, 474–554, 481–371, and 552, and the local variety Blanca or Imilla received a resistance rating of 1 or 2 on a scale from 1 to 5. The last-named also carries relative resistance to [unspecified] virus diseases.

Hartman (R. E.). **Potato wart eradication program in Pennsylvania.**—*Amer. Potato J.*, **32**, 9, pp. 317–326, 5 figs., 1 map., 1955.

Potato wart (*Synchytrium endobioticum*) [*R.A.M.*, 33, p. 174] infections in Pennsylvania were all found in the zone of the 120 to 130 days' growing season, in which the seasonal mean soil temperature is 63° to 66° F. Wart has persisted in abandoned lands for 25 or more years. In lands abandoned owing to the closing of mines, 'total destruction' of the pathogen was achieved by applying 10,000 lb. copper sulphate to the acre; rough areas near walks and foundations are treated in autumn and a 10 per cent. solution of 40 per cent. formaldehyde (20 gals. per 100 sq. ft.) is applied to lawns, flower beds, shrubs, and trees.

'Spot treatment' involves an autumn inspection of harvested potatoes and treating an area of 25 sq. ft. around each infected hill with 10 per cent. formaldehyde solution (2 gals. per sq. ft.). If more than 1 per cent. of the hills contain infected potatoes, the whole area is 'totally destroyed' or 'totally eradicated'. For the latter the cultivated portion of the land is planted with immune Cobbler for one season to ensure decomposition of the wart masses, harvested in August, and treated with copper sulphate (10,000 lb. per acre) after autumn frosts have killed plant growth; subsequently it is kept fallow with periodic disking; after a year the areas are limed (10,000 lb. per acre), and six weeks later seeded with a mixture of rye and grass, until late in the following spring, when they are ploughed, disked, and planted with vegetables.

Jensen (J.). **Forsøg med tidlige, brokimmune sorter af Spisekartofler, 1950–1953.** [A trial of early, wart-immune varieties of cooking Potatoes, 1950–1953.]—*Tidsskr. Planteavl*, 59, 1, pp. 80–95, 1955. [English summary.]

A tabulated survey is given of experiments carried out at three localities in

Denmark to ascertain the cultural values of six early potato varieties immune from wart disease [*Synchytrium endobioticum*: *R.A.M.*, 34, p. 347], viz., Primula (used as a standard), Saskia, Arran Pilot, Ulster Chieftain, Ulster Commerce, and Ulster Premier, the two first-named having yellow and the others white flesh.

Arran Pilot gave the heaviest yields at all three lifting dates (1st July, a fortnight later, and at full maturity), but it produced a number of tubers exceeding 5 cm. in diameter and tended to coarsen on ripening. The flavour is moderately good but darkening is apt to develop after cooking. Primula and Saskia were about equally productive and the tubers are similar in appearance, with good cooking qualities. All the Ulster varieties are of a somewhat floury consistency; Premier gave the lowest yields.

Other points of interest are as follows. Primula is highly susceptible to blight [*Phytophthora infestans*: loc. cit.] of the tops, the tubers being only moderately affected. Arran Pilot, also very susceptible to blight, is reported to be resistant to scab [*Actinomyces scabies*: 32, p. 396]. Saskia is liable to severe attacks of blight. Of the Ulster varieties, Chieftain is alleged to be highly susceptible to *P. infestans*, while the other two sustain relatively little damage from this source.

Focke (R.). **Rhizoctonia-Resistenzprüfung an Sämlingen einiger Wild- und Kulturkartoffeln.** [The testing of some wild and cultivated Potato seedlings for *Rhizoctonia* resistance.]—*Züchter*, 25, 4–5, pp. 138–140, 4 graphs, 1955.

A laboratory method for the assay of resistance to *Rhizoctonia* [*Corticium solani*] in potato seedlings is reported from the Institute for Breeding Biology, University of Rostock, Germany [*R.A.M.*, 34, p. 174]. The seeds were germinated in Petri dishes and when the roots were 2 to 4 mm. long the seedlings were transferred to finely sifted, steamed compost soil and covered with a thin layer. On emergence they were inoculated with strain S39 of the fungus from the Biological Institute, Berlin-Dahlem, by laying strips or small disks from cultures between the rows. The entire experimental process was conducted in darkness to increase susceptibility, and in continuous high humidity; later the seedlings were also watered daily. The temperature during the tests fluctuated between 20° and 22° C. The total of 10,674 seedlings comprised 2,258 of *Solanum demissum* Malchow 49, 1,674 of *S. longipedicellatum*, 457 of *S. antipoviczii*, 683 of *S. schenckii*, and 5,602 hybrids of Cornelia × Wega, Cornelia × Aquila, Cornelia × Pepo, Cornelia × Johanna, Cornelia × Malchow 43.5/137, Immertreu × Aquila, and Ostbote × Malchow 43.5/137, and selfed Mittelfrühe, Merkur, and Aquila.

The greatest average differences in rate of necrosis of the seedlings were observed between *S. demissum* Malchow 49 and *S. longipedicellatum*, the former reaching the same stage of severity two to three days later than the latter. Next in resistance to *S. demissum* Malchow 49 came *S. schenckii* and Mittelfrühe (used as a standard of comparison), while there was little difference in susceptibility between *S. longipedicellatum* and *S. antipoviczii*. Similarly, no appreciable differences in reaction were detected among the various hybrids between cultivated varieties, most of which succumbed by the ninth day.

Zaleski (K.) & Błaszczak (W.). **Wstępne doświdczenia nad patologią, szkodliwością, i niektórymi sposobami zwalczania rizoktoniozy Ziemniaków (Rhizoctonia solani Kuehn).** [Preliminary experiments on the pathology, damage, and certain means of controlling rhizoctoniosis of Potato (*Rhizoctonia solani* Kuehn).]—*Roczn. Nauk rol.*, 69, 4, pp. 529–556, 1 pl., 2 figs., 2 diags., 1954. [Russian and English summaries.]

In 1950 experiments were carried out on loam soil at the Poznań University Experimental Farm, Poland, on infection by *Rhizoctonia* [*Corticium*] *solani* [*R.A.M.*, 34, p. 745; cf. 35, p. 38], using the potato variety Merkur. Potatoes

almost free from *C. solani*, used as controls, were compared with those infected lightly in one case and rather more in another, one series of the latter being fertilized with 100 kg. of potassium oxide per ha. and another planted at a depth of 15 cm. It was found that infection delayed and reduced sprouting, that excessive potassium fertilization decreased infection, and that deep planting increased it.

ERIKSON (DAGNY). **Loss of aerial mycelium and other changes in streptomycete development due to physical variations of cultural conditions.**—*J. gen. Microbiol.*, 13, 1, pp. 136–148, 2 pl., 1955.

At the Bacteriology Department, University of Aberdeen, the growth of strains Sc10, 5, and 4 of *Streptomyces* [*Actinomyces*] *scabies*, respectively highly, moderately, and weakly pathogenic to potato, were studied under various physical conditions [*R.A.M.*, 29, p. 163], viz., in a pectin plus ammonium salt liquid medium and an aqueous Czapek nitrate medium containing insoluble chitin; on plane and non-nutritive surfaces such as glass coverslips and cellophane films superimposed on different nutrients; and in agar media with and without the anionic detergent gemex 29. Lowering the surface-tension of the medium by means of the detergent reduced aerial growth, strain 10, which produced the least aerial mycelium on stock nutrient agar, being the most susceptible and strain 4 the least. Distorted aerial growth on detergent agar resembled the irregular, swollen, sporogenous filaments produced in the pectin plus ammonium salt liquid media and were reminiscent of cases of sporogenesis in submerged cultures described by other workers (*Rev. Immunol.*, 18, p. 265, 1954).

STEVENSON (F. J.), MCLEAN (J. G.), HOYMAN (W. G.), & AKELEY (R. V.). **Early Gem : A new early, russet-skin, scab-resistant variety of Potato adapted to the early Potato-producing sections of Idaho and to certain sections of North Dakota.**—*Amer. Potato J.*, 32, 3, pp. 79–85, 1955.

Early Gem, a new early-maturing potato, is highly resistant to scab [*Actinomyces scabies*: *R.A.M.*, 35, p. 121] and may have some resistance to the purple top wilt virus [aster yellows virus: cf. 32, p. 234; 34, p. 54], but seems to be susceptible to all other major potato diseases. It can be used in most scab-infested soils if these are properly drained and not too heavy.

STEINECK (O.). **Untersuchungen und Beobachtungen über die Fadenkeimigkeit von Kartoffelknollen.** [Studies and observations on spindle sprout of Potato tubers.]—*Phytopath. Z.*, 24, 2, pp. 195–210, 3 figs., 1955.

The methods and results of investigations covering the period from 1949 to 1954 on spindle sprout of potato tubers at the Institute for Soil Culture, Vienna [*R.A.M.*, 32, pp. 501, 692], are fully described. Microscopic examination clearly demonstrated the under-development of the bud primordia in the 'eyes' of spindle-sprouting tubers as compared with normal ones, especially in respect of the vascular bundles. In field experiments a definite correlation was also observed between spindle sprout and the prevalence of dry, hot weather during tuber formation. Only a certain proportion of seedlings arising from crosses between Bintje and Flava, Sieglinde × Flava, and selfed Sieglinde produced spindle-sprouting tubers at the same stage of development, indicating that a predisposition to the defect is hereditary. Here again the favouring influence of heat and drought was apparent.

The results of a combined irrigation and fertilizing experiment in 1953 showed that spindle sprout could be prevented by watering (irrespective of the soil amendment) according to a system devised by Kopetz (*Bodenkultur*, [7], pp. 199–207, 1953; *Kalibriefe*, Folge 2, Fachgebiet 8, 1954; *Int. Landmaschinenmarkt, 1954*, pp. 526–527, 1954) as soon as the moisture content of the soil falls below 50 per cent. of the water-holding capacity. In tests on the Jakobi variety six applications

were required, each of 30 mm., on 19th, 23rd, and 29th June and 3rd, 10th, and 24th July. On unirrigated plots spindle sprout was more prevalent at the higher nitrogen levels.

HELSON (G. A. H.). **Plant quarantine in New Zealand since 1884.**—*N.Z.J. Agric.*, 90, 2, pp. 114–117, 119, 121–123, 13 figs., 1955.

The author reviews the history and importance of the plant quarantine service in New Zealand [cf. *R.A.M.*, 35, p. 79] since 1884, emphasizing that the fullest public support and the importer's sound knowledge of quarantine regulations are necessary for its success.

MOORE (W. C.). **The development of international co-operation in crop protection.**—*Ann. appl. Biol.*, 42 (*Proc. Jubilee Meeting, London, 13–17 Sept., 1954*), pp. 67–72, 1955.

The progress made towards the achievement of international co-operation in combating plant diseases and pests since the second World War is reviewed [*R.A.M.*, 34, p. 134 and see following abstracts]. There is still much overlapping of effort, and a growing tendency towards relatively small conferences on special subjects is evident.

There are certain basic requirements for every country, such as a reliable phytopathological service responsible for nursery inspections, supervision of imports, and intelligence work on the incidence and distribution of plant pests and diseases. Also prompt disclosure of information must be possible without fear of the imposition of embargoes or import regulations, and restrictions must be scientifically sound, combining maximum security with minimum interference with trade. The implications of the certificates that accompany the importation of plants or plant parts must be perfectly clear.

The International Plant Protection Convention of 1951 [34, p. 280] and the European Plant Protection Organization (EPPO), set up in 1950 [33, p. 336; cf. also 32, p. 224 and next abstract] indicate the progress already made.

WILKINS (V. E.). **International co-operation in action.**—*Ann. appl. Biol.*, 42 (*Proc. Jubilee Meeting, London, 13–17 Sept., 1954*), pp. 73–75, 1955.

The author reviews the activities of the European Plant Protection Organization [see preceding abstract] since its inception in 1947. The organization now deals with several pests and diseases, including potato wart (*Synchytrium endobioticum*) and is responsible for a reporting service integrated with FAO. It illustrates the advantages of starting such a body in a small way with entirely practical aims and no political implications.

GRAM (E.). **Barriers and by-passes in plant trade.**—*Ann. appl. Biol.*, 42 (*Proc. Jubilee Meeting, London, 13–17 Sept., 1954*), pp. 76–81, 1955.

The author draws attention to the dangers of illegal trade and the carelessness of tourists and others in facilitating the spread of plant diseases from one country to another despite quarantine precautions. Both out-port and in-port inspection are desirable, but the ideal arrangement would be for an accompanying inspector from the importing country to assist at the out-port, thus saving much in-port inspection.

Some of the problems and practice of field inspection and seed disinfection are described, with illustrations from Denmark, and it is stressed that phytosanitary services in individual countries must bring their internal control to a high standard. Then, with co-operation, exchange of plant material with others similarly placed will be easier, and the need to bar certain plant imports reduced.

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